

UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

Vol. 6 No. 11

Abstracts 3146-3480

June 15, 1952



Technical Information Service, Oak Ridge, Tennessee

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PRINTED IN U.S.A.
PRICE 25 CENTS

The printing of this publication has been approved by the
Director of the Bureau of the Budget, August 2, 1951.

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NOTE ON THE DOPPLER EFFECT, by R. R. Coveyou.
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EQUIVALENT AGES IN MOUSE AND HUMAN EMBRYOS, by Eileen M. Otis and Robert Brent. Apr. 2, 1952. 29p. (UR-194)
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MEASUREMENTS OF AVERAGE HEAT-TRANSFER AND FRICTION COEFFICIENTS FOR SUBSONIC FLOW OF AIR IN SMOOTH TUBES AT HIGH SURFACE AND FLUID TEMPERATURES, by Leroy V. Humble, Warren H. Lowdermilk, and Leland G. Desmon. 1951. 15p. (NACA-1020)
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SOLUTION, by Arthur W. Adamson. [nd] 21p. (NP-3720;
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Nov. 20, 1950. Decl. June 1, 1950. 32p. (NP-3722;
Report No. ES401-14; R&D-5036; U62448)
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RESEARCH INVESTIGATION OF IONIZATION CHAMBERS;
THIRD QUARTERLY REPORT NOVEMBER 1, 1951 - JANU-
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Lydia Savedoff. [nd] 12p. (NP-3728; Technical Report
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[nd] 8p. (NP-3765)
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Central Aerosol Labs., Columbia Univ.
PROGRESS REPORT NO. 4 COVERING PERIOD FROM SEP-
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Mary Louise Young. Nov. 31, 1950. 9p. (NP-3771)
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PROGRESS REPORT NO. 5 COVERING PERIOD FROM DE-
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FORWARD ANGLE SCATTERING CAMERA FOR THE DE-
TERMINATION OF PARTICULATE CONCENTRATION OF
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SETTLINGS, by Joseph Benedict and Guy G. Goyer. [nd]
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- NP-3789 3231
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THE DETERMINATION OF URANIUM IN ORES; FLUORO-
PHOTOMETRIC METHOD; A PROCEDURE FOR THE RE-
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DISTORTION OF TRANSIENTS IN THE CYLINDRICAL ION
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Naval Radiological Defense Lab.
AN AUTORADIOGRAPHIC METHOD OF DETECTING AND
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GENEOUS MIXTURE, by Philip D. LaRiviere and Stephen
K. Ichiki. Mar. 27, 1952. 18p. (USNRDL-342)

GENERAL

ATOMIC BOMBS AND WARFARE
3146

ORGANIZATION OF THE PUBLIC HEALTH SERVICE OF CROWDED POPULATION CENTERS IN ANTICIPATION OF MASSIVE BOMBARDMENTS. HEALTH SERVICE TACTICS IN CASE OF AN INFLUX OF INJURED. H. Glorieux. Bruxelles-méd. 32, 394-410(1952) Feb. 24. (In French)

Local, regional, and national organization of the medical services in order to cope with an atomic bomb attack is discussed. Practical aspects of the collection and disposition of large numbers of casualties are considered.

BIOLOGY AND MEDICINE

3147

California Univ., Berkeley
ACETYLATION OF AMINO ACIDS BY ENZYMES OF CLOSTRIDIUM KLUYVERI, by J. Katz, I. Lieberman and H. A. Barker. [nd] 34p. (AECU-1968)

Acetyl phosphate and glycine have been shown to be converted almost quantitatively to acetyl glycine by dried cell preparations of Clostridium Kluuyveri in the presence of cyanide. The influence of substrate concentrations and other factors on the reaction rate have been studied and the optimal conditions established. Amino acids and a variety of aliphatic amines are reactive in this system, but not aromatic amines or choline. Monoacetyl lysine, probably substituted in the alpha position, is the main product of lysine acetylation. Acetylated amino acids do not undergo hydrolysis or participate in transacetylation reactions either in the presence or absence of cyanide. A method for the estimation of acetylated amino acids is described. (auth)

3148

Brookhaven National Lab.
GLUCOSE DISSIMILATION BY RHIZOPUS, by Martin Gibbs and Ruth Gastel. [nd] 12p. (BNL-1146)

When R. oryzae ferments glucose-1-C¹⁴, label appears predominantly in the methyl carbon of lactic acid and in the methyl carbon of alcohol. The carbon dioxide contained only traces of label. When R. oryzae ferments glucose-3, 4-C¹⁴, label appears in the carbon dioxide and in the carboxyl carbon of lactic acid but not in the ethanol. When R. oryzae oxidizes glucose-1-C¹⁴, only traces of non-carboxyl carbons of label appear in ethanol. The distribution of label in the lactic acid is similar to that formed fermentatively. The labeling found indicates that R. oryzae converts glucose to lactic acid aerobically and anaerobically in accordance with the Embden-Meyerhof-Parnas scheme. It was further concluded that under the oxidative conditions employed in these experiments that the carbon atoms of glucose did not yield lactate via the 4-carbon dicarboxylic acids. (auth)

3149

Atomic Energy Project, Univ. of Rochester
EQUIVALENT AGES IN MOUSE AND HUMAN EMBRYOS, by

Eileen M. Otis and Robert Brent. Apr. 2, 1952. 29p. (UR-194)

A table and graph for estimating equivalent ages of mouse and human embryos is presented. The determination was made by matching stages of embryonic structures in both organisms. Each structure appears graphically as a coordinate of the time at which it was observed in mouse embryos of known mating age and the time at which it was reported to appear in human embryos. The rate of development of the mouse with respect to the human increases with increasing age, particularly after the 14th day. Equivalency cannot be based on percent or elapsed pregnancy or the comparison of stages other than the one for which an equivalent estimate is needed. Mouse strains may differ by as much as 24 hours in their developmental rates so that application of the equivalency graph to data obtained from strains other than the one used in this investigation requires a comparison of one or more embryos with the time table. (auth)

3150

THERAPY OF INJURIES CAUSED BY ATOMIC BOMBS.
Charles Sillevaerts. Bruxelles-méd. 32, 606-15(1952) Mar. 23. (In French)

The clinical picture, first aid, and medical treatment of crush or compression injury and burns, such as might be caused by an atomic bomb explosion, are discussed.

3151

THERAPY OF INJURIES CAUSED BY ATOMIC BOMBS.
Charles Sillevaerts. Bruxelles-méd. 32, 699-708(1952) Apr. 6. (In French)

The clinical picture, first aid, and medical treatment of burns resulting from flames and of radiation injuries, such as might be caused by an atomic bomb explosion, are discussed.

3152

THERAPY OF INJURIES CAUSED BY ATOMIC BOMBS.
CONCLUSION. Charles Sillevaerts. Bruxelles-méd. 32, 762-72(1952) Apr. 13. (In French)

Detection of radiation and treatment of radiation injuries resulting from an atomic bomb explosion, residual radiation, or radiological warfare are discussed briefly.

RADIATION EFFECTS

3153

Los Alamos Scientific Lab.
AN INVESTIGATION INTO THE MECHANISM WHEREBY EXTREME HYPOTHERMIA INCREASES THE SURVIVAL OF INFANT MICE GIVEN A LETHAL DOSE OF X RAYS, by John B. Storer and Louis H. Hempelmann. [nd] 18p. (AECU-1961; LADC-1159)

The survival of infant mice irradiated while in a state of extreme hypothermia (about 5°C) is almost twice that of litter mates exposed to the same doses of total-body x rays at room temperature. The mortality rate was not affected in infant animals less severely chilled, or in adult mice refrigerated after being anesthetized. The protection afforded by extreme chilling was of about the same degree as that produced by placing the animals in a nitrogen atmosphere; furthermore, combining anoxia with refrigeration did not enhance the radiation protection. The benefit derived

from extreme chilling was less if animals were placed in pure oxygen rather than in nitrogen. It was concluded that lowered tissue oxygen tension played an important, if not crucial, role in increasing the survival rate of chilled infant mice. (auth)

3154

Cancer Research Inst., New England Deaconess Hospital, Boston

MECHANISMS IN ACQUIRED RADIORESISTANCE OF CANCER, by P. O'B. Montgomery and Shields Warren. [nd] 10p. (AECU-1991)

The transplant survival data obtained when Gardner mouse lymphosarcoma 6C3HED is given increasing in vitro doses of x radiation are presented. The possible mechanisms underlying the well known clinical observation of acquired radioresistance in cancer therapy are discussed. It is concluded from the studies that the mechanism of acquired radioresistance in the Gardner mouse lymphosarcoma is probably an alteration of the host-tumor relationship as a consequence of the host's response to the x radiation rather than to a direct effect of the x radiation on the tumor cell itself. (auth)

3155

Radiation Lab., Univ. of Calif.

MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT; JULY, AUGUST, AND SEPTEMBER, 1951. Nov. 5, 1951. Decl. Apr. 25, 1952. 56p. (AECD-3354; UCRL-1561)

Separate abstracts have been prepared on the following sections of this report: The Metabolic Properties of Various Materials p.4-31, and Biological Studies of Radiation Effects p.32-52.

3156

Radiation Lab., Univ. of Calif.

THE METABOLIC PROPERTIES OF VARIOUS MATERIALS, p.4-31 of **MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT; JULY, AUGUST, AND SEPTEMBER, 1951.** Nov. 5, 1951. Decl. Apr. 25, 1952. 28p. (AECD-3354(p.4-31))

A study of radioautographs of liver from rats, injected with radiogold 1 day previously, showed 50% of the gold deposited; those injected 4 days previously showed 43% remaining. Careful dark-field examination at high magnification showed particulate matter of the order of $2\ \mu$ in size present in the Kupffer cells. These were of random distribution, and, wherever there was evidence of activity from the radiogold accumulated in the liver, there was present one of these small unidentified particles. However, only some of the particles were associated with the photographic evidence of the presence of radiogold, thus suggesting the radiogold was adsorbed on the particulate matter held by the reticulo-endothelial system. Tissue distribution studies are reported for rats administered W, Tl, Sc, Au, and Tm. Results are presented in tabular form. Preparation is reported of carrier-free Au^{195} , 196 , 198 , 199 , W^{181} , and Ir^{188} , 190 , 192 . Modifications are reported in the design of a centrifugal-pump target assembly for cyclotron irradiation of liter amounts of solution under controlled conditions. Ir-radiation-induced oxidation of the ferrous ammonium sulfate system was investigated using this assembly. Results are presented graphically.

3157

Radiation Lab., Univ. of Calif.

BIOLOGICAL STUDIES OF RADIATION EFFECTS, p.32-52 of **MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT; JULY, AUGUST, AND SEPTEMBER, 1951.** Nov. 5, 1951. Decl. Apr. 25, 1952. 21p. (AECD-3354(p.32-52))

Use of a γ -ray pinhole camera for taking radioautographs in vivo of a tumor containing 20 mc of I^{131} is reported. Design of the camera and techniques used are discussed. Use of the pinhole camera for evaluation of distribution of sur-

face contamination is suggested. A pinhole camera mounted on a truck so as to be 20 or 30 ft above ground was shown to survey 1000 sq ft in a single picture. In 30 min a satisfactory image was obtained from 0.5 mc/cm² contamination. Determination of total body water in 55 individuals by the tritium oxide dilution method is reported and the method discussed in detail. Comparison is made of this method with others for determining total body water. Body water data for individuals in normal condition and those in diseased states are presented in tabular form.

3158

Atomic Energy Project, Univ. of Calif., Los Angeles

CLEARANCE OF PRODIGIOSIN DUST FROM THE RESPIRATORY TRACT OF NORMAL AND X-IRRADIATED RABBITS, by George V. Taplin, James S. Grevior, Camille Finnegan and Arthur Dunn. Issued Apr. 10, 1952. 15p. (UCLA-191)

The rate and efficiency with which the rabbit's respiratory tract removes inhaled insoluble particles has been determined by the use of prodigiosin, a dye which may be extracted from tissue specimens and measured accurately in minute quantities. All animals were given a single 30-minute exposure to an atmosphere containing prodigiosin dust. By serial sacrifice techniques, it has been shown that the nasopharyngeal passages are cleared far more rapidly and completely than the lung parenchyma in both normal and roentgen irradiated animals. When rabbits are given 800 r whole-body x irradiation followed by a single inhalation exposure to prodigiosin dust, the removal of these insoluble dye particles from the nasal mucosa and from lung tissue is greatly accelerated and the efficiency of its clearance is definitely increased over that of the normal animal, especially at the fourteenth and twenty-eighth post-irradiation days. The probable clinical significance and the mechanism of this beneficial effect from whole-body x irradiation are discussed and the need for further investigation is stressed. (auth)

3159

Applied Fisheries Lab., Univ. of Wash.

THE RELATIONSHIP BETWEEN Ca^{45} , TOTAL CALCIUM AND FISSION PRODUCT RADIO-ACTIVITY IN PLANTS OF PORTULACA OLERACEA GROWING IN THE VICINITY OF THE ATOM BOMB TEST SITES ON ENIWETOK ATOLL, by O. Biddulph and Robert Cory. [nd] 20p. (UWFL-31) Analyses were made for total radioactivity, radioactivity due to Ca^{45} , and for total Ca in plants of the species *Portulaca oleracea* collected approximately 15 months after the 1948 atom bomb tests at Eniwetok Atoll. (Supplement to sect. VI of UWFL-23)

3160

THE EFFECT OF IONIZING RADIATIONS OF THE BROAD BEAN ROOT. PART X. John Read. *Brit. J. Radiology* 25: 154-9(1952) Mar.

Experiments are described from which the following conclusions are drawn. The decrease in sensitivity of the broad bean root to x rays is the same whether anaerobiosis is produced by bubbling nitrogen, argon, or hydrogen, through the water in which the roots are immersed. Oxygen supplied immediately after x irradiation under anaerobic conditions has no effect. When the oxygen concentration in the water in which the roots are immersed is rapidly changed, the sensitivity to x rays of the roots follows with a time lag, certainly not greater than one minute, if any. The oxygen concentration acts as a simple multiplying factor on the dose. When the multiplying factors are plotted against the concentration of oxygen in the water, a sigmoid curve results, which has its maximum slope at about 5 cc/l, and reaches a constant maximum of 3 in the range 15 to 20 cc/l, i.e., a three times greater dose must be given with no oxygen present than is

necessary with 10 cc/l to produce the same effect on the roots. The oxygen consumption of the root has been measured. When the concentration gradient necessary to supply this amount is calculated it appears that the oxygen concentration in the root must be considerably less than that in the water. The histological appearances of root tips irradiated with and without oxygen seem qualitatively the same, but roots irradiated with oxygen are affected to a much greater degree. In particular the inhibition of mitosis is greater. It is considered probable that these conclusions have close parallels in the case of x irradiation of animal tissues in general, including human neoplasms as a most important example. (auth)

- 3161
APPLICATION OF THE QUANTUM HIT THEORY TO VIRUS-PROVOKED TUMOURS. Niels Arley and Simon Iversen. *Nature* 169, 410-11(1952) Mar. 8.

The fundamental assumption of the hit hypothesis is that most, if not all, biological processes are ultimately governed by certain control centers, which are situated in the cell nuclei and are thought of as giant molecules making quantum jumps when acted upon by different agents such as chemical substances, viruses, neutrons, x rays and other ionizing radiations. In the case of mutations, these centers are now generally believed to be genes. It is assumed that there is in each cell a certain control center, perhaps of an enzyme-like nature, which controls the velocity of the chemical chain reactions which in turn control the velocity of growth and thus the rate of proliferation of the cells. The theory has been applied to cancer produced by viruses, and there is good agreement with experimental findings. The logarithmic dependence of induction time on concentration as deduced from the theory supports the feasibility of applying the quantum-hit theory to the problems of cancer production.

- 3162
MORTALITY OF MICE AFTER TOTAL BODY IRRADIATION AS INFLUENCED BY ALTERATIONS IN TOTAL DOSE, FRACTIONATION, AND PERIODICITY OF TREATMENT. Henry S. Kaplan, and Mary B. Brown. *J. Natl. Cancer Inst.* 12, 765-75(1952) Feb.

The lethality of total-body x irradiation was studied in 1,753 strain C57 black mice of both sexes, 1 month old at the start of treatment. There was no sex difference in mortality. Analysis of the data by the probit method yielded regression lines with LD_{50} values of $486 \text{ r} \pm 18$ for single exposures, increasing to $542 \text{ r} \pm 22$, $678 \text{ r} \pm 71$, and $850 \text{ r} \pm 80$ for 2, 4, or 8 daily fractionated exposures, respectively. A mathematical model is presented that fits the present data for daily fractionation and provides a tentative framework for additional dose-response experiments.

- 3163
IS THE BIOLOGICAL ROLE OF POTASSIUM RELATED TO ITS RADIOACTIVITY? Guillaume Valette and Charles Combescot. *Compt. rend. soc. biol.* 145, 1625-7(1951). Nov. (In French)

Tyrodé's solution was prepared without K but with enough tracer K^{42} to produce the same specific radioactivity as a solution containing normal K. In this solution a fragment of rabbit ileum ceased to contract in 180 to 220 min, rat duodenum ceased to contract in 40 to 60 min, the "potassium paradox" could not be observed, and spontaneous contractions could not be induced after 7-days refrigeration. In Tyrodé's solution prepared by substituting the same molarity of K^{42} as that of K in normal solution, thus having 50,000 to 100,000 times the specific activity, no difference in behavior of intestinal fragments was noted except a 50% reduction in the contraction amplitude. It is concluded that the radioactive properties of K have no preponderant effect on the element's biological action.

- 3164
HISTOLOGICAL CHANGES INDUCED IN BARLEY PLANTS BY RADIATION FROM P^{32} . Ruth W. Mackie, James M. Blume, and C. E. Hagen. *Am. J. Botany* 39, 229-37(1952) Mar.

Cell division ceased when a meristematic region, such as that of a root or shoot tip, was subjected to a constant, relatively high level of radiation from P^{32} . The cells of the growing points enlarged; the cytoplasm in these cells became less dense; the cell walls thickened. In short, the region took on a somewhat abnormally mature appearance. The growing regions of shoots and roots of barley were affected by ionizing radiation in a similar manner, but not to the same degree. Plants grown in solutions of comparatively low specific activity exhibited clear evidence of damage to shoot meristems, but no apparent injury to root tips. Measurements of arc lengths of shoot tip cells gave no indication of a threshold value for radiation effect upon meristematic cells. (auth)

- 3165
BIOLOGICAL ACTION OF RADIUM BETA RADIATION (THE CURTIS F. BURNAM TUBE). Jean Moulinard. *J. radiol. électrol.* 33, 156-61(1952). (In French)

The Burnam tube contains 50 mg of Ra filtered by 0.3 mm of monel metal. A physical and biological evaluation of its feebly penetrating β rays is presented. A skin application of 5-min duration (1800 rep) causes an erythematous reaction of the second degree, whereas a 50-min exposure (18,000 rep) results only in a radioepithelitis with satisfactory cicatrization. In addition to its cauterizing action, the radiation has a selective effect on radiosensitive tissues. Therapeutic application of the Burnam tube to the skin, ear, eye, etc., is discussed.

- 3166
ACTION OF X RAYS ON THE CARDIAC FUNCTION OF BUFO VULGARIS. II. ELECTROCARDIOGRAPHIC OBSERVATIONS. Giancarlo Lischi and Alberto Pacciardi. *Radioterapia radiobiol. e fis. med.* 4, 308-14(1952). (In Italian)

Electrocardiographs of *Bufo vulgaris* following 200-, 300-, or 1000-r x irradiations are illustrated and discussed.

- 3167
SERIOUS ALTERATION OF SKELETAL GROWTH FOLLOWING THERAPEUTIC ROENTGEN IRRADIATION IN EARLY LIFE. Ruggero Camera. *Radioterapia radiobiol. e fis. med.* 4, 257-68(1951). (In Italian)

Detailed observations on a 13-yr-old boy with extreme hypoplasia of the right arm resulting from roentgen irradiation in infancy of an angioma are reported. A critical review of the literature on the effects of radiation on bone development is included.

- 3168
EFFECT OF X RAYS ON THE METABOLISM OF THE NUCLEIC ACIDS. Mario Paoletti. *Radioterapia radiobiol. e fis. med.* 4, 225-36(1951). (In Italian)

The effect of 100 to 200 r of x radiation on nuclear staining of epidermal cells of the guinea pig was investigated. A decrease in nucleic acids, particularly thymonucleic and ribonucleic acids, is suggested.

- 3169
NEW EXPERIMENTS ON THE EFFECTS OF ROENTGEN RADIATION AND FLUORESCENCE RADIATION OF CALCIUM TUNGSTATE ON THE FORMATION AND EVOLUTION OF CALLUSES IN EXPERIMENTAL FRACTURES. Braggion Paolo and Ravazzolo Sinclair. *Radioterapia radiobiol. e fis. med.* 4, 300-7(1951). (In Italian)

Experimental fractures in rabbits were treated by x irradiation or by insertion of CaWO_4 near the fracture and subsequent x irradiation. The process of healing was observed. Essentially negative results as to the effects of the

x or fluorescence radiation on the repair process were found.

3170

ON THE EFFECT OF LARGE DOSES OF X RAYS ON TISSUE CULTURES. M. N. Meisel, T. M. Kondrat'eva, and K. H. Emel'yanov. *Doklady Akad. Nauk S.S.S.R.* **81**, 1047-50 (1951). (In Russian)

Cultures of tumorous tissue from a mouse milk gland were exposed to 5000 to 500,000 r of 90-kv x rays at the rate of 8300 r/min. Effects on cells and nuclei are described briefly.

3171

CILIARY MOVEMENT AND ACETYLCHOLINE. Pamela Kordik, E. Bulbring, and J. H. Burn. *Brit. J. Pharmacol.* **7**, 58-66(1952) Mar.

Since x-irradiation caused obvious changes (e.g., diarrhoea) in the intestinal tracts of rats, an investigation was made of the responses of isolated loops of intestine taken from irradiated rats to acetylcholine and histamine. Increased responses were observed to acetylcholine in the colon 24 hr after irradiation. Increased responses were likewise observed in the duodenum, jejunum, and ileum after 48 hr. No similar changes in response to histamine were observed. The cholinesterase activity was determined in loops of intestine from irradiated rats. After 48 hr the amount of "pseudo" or "non-specific" cholinesterase was found to have fallen to about half in the jejunum and ileum, this being true of suspensions of the whole gut and of muscle coats only. There was no fall in "true" or "specific" cholinesterase. Some fall in "pseudo"-cholinesterase was already evident in both colon and ileum 24 hr after irradiation. (auth)

3172

THE LIMIT OF RENAL TOLERANCE TO X RAYS: AN INVESTIGATION INTO RENAL DAMAGE OCCURRING FOLLOWING THE TREATMENT OF TUMOURS OF THE TESTIS BY ABDOMINAL BATHS. P. B. Kunkler, R. F. Farr, and R. W. Luxton. *Brit. J. Radiology* **25**, 190-201(1952) Apr.

The clinical picture of renal failure associated with hypertension following x-ray abdominal baths for seminoma testis is described. Swelling of the ankles, headaches and breathlessness, with albuminuria, hypertension, anaemia and nitrogen retention develop after a latent period of six to twelve months. Death may occur from uraemia, cardiac causes, or cerebral hemorrhage. Techniques which have been employed in the prophylactic irradiation of cases of seminoma testis are described. The survival rates in 93 cases and the incidence of renal failure are correlated with the distribution of dose through the kidneys. In the cases developing renal failure the whole of both kidneys had received a dose of 2300 r or over in five weeks. A fall in dose to the upper poles of both kidneys characterised the "safer" techniques and, at the dose levels employed, is considered of greater significance than either the maximum dose or the integral dose received by the kidneys. Where x-ray baths of the abdomen deliver a central dose of 3000 r or under in five weeks, the risk of renal failure may best be minimized by ensuring that about one-third of the volume of the kidneys is outside the fields or is at least irradiated to as low a dose as possible. Renal function and location should be determined before x-ray treatment of the abdomen is undertaken. (auth)

3173

BODY WEIGHT, FASTING AND FORCED FEEDING AFTER WHOLE BODY X-IRRADIATION. Willie W. Smith, Isabelle B. Ackermann, and Falconer Smith. *Am. J. Physiol.* **168**, 382-90(1952) Feb. 1.

The weight pattern in rats, mice and guinea pigs following whole-body x irradiation was a stronger characteristic of

species than of dose or lethality. Fasting did not significantly alter mortality. Forced feeding a partially predigested diet by stomach tube was detrimental to rats when the feedings were given during the first 3 days following irradiation, but was not damaging when given after the fourth day. Stasis of the alimentary contents of the rat was observed after radiation, principally in the stomach. (auth)

3174

EFFECT OF THE MEDIUM ON THE BEHAVIOR OF METHYLENE BLUE IN THE PRESENCE OF ELECTROMAGNETIC RADIATIONS. Camille Piffault, Paul Blanquet, and Joseph Duhamel. *J. phys. radium* **13**, 13S-14S(1952) Mar. (In French)

Methylene blue was dissolved in an ionizing medium, water, and an un-ionizing one, glycerin, which were then exposed to I^{131} γ rays, x rays, ultraviolet light, or infrared light. In water, discoloration was never complete and was not reversible, formation of a leuco derivative was never observed, and the presence or absence of O_2 had no effect. In glycerin, complete discoloration could be obtained, even visible and infrared light being effective, and the discoloration was caused by formation of a leuco derivative, which recolored spontaneously in air. Formation of a labile complex of the dye with the glycerin is suggested.

3175

EFFECTS OF X RAYS AND RADIUM ON THE NUCLEI OF CANCEROUS CELLS. L. Cusmano. *Acta Unio Intern. contra Cancrum* **7**, 822-3(1952). (In French)

On a rat sarcoma induced by benzopyrene and exposed to 200 r of x radiation and on an epithelial cancer of the cervix treated with 20 mg of Ra, the radiations caused disappearance of Casperson type A (proliferating) cells and considerable increase in the number of type B (resting or disappearing) cells. The hyperploid cells seemed to be more resistant; their number may be an explanation of the radioresistance or recurrence of certain types of tumors.

3176

ANALYSIS OF DIFFERENT FACTORS RESPONSIBLE FOR THE DEATH OF MICE IRRADIATED IN TOTO. H. Betz. *Acta Unio Intern. contra Cancrum* **7**, 814-17(1952). (In French)

The protective action of KCN against x irradiation is exerted only on those tissue lesions resulting from general metabolic disturbances, such as changes in lipid production of the adrenal cortex and the liver, and not on radiolesions. It is concluded that the cause of mouse death in whole-body irradiation is the general alarm syndrome.

3177

EXPERIMENTAL RADIATION INDUCED OVARIAN TUMORS: ADENOCARCINOMA WITH HYPERVOLEMIA. Jacob Furth and J. B. Kahn. *Acta Unio Intern. contra Cancrum* **7**, 827-30(1952)

The complex ovarian tumors caused by irradiation have been resolved through successive and selected transplantations into definite types. The luteomas produce masculinization, polycythemia and features of Cushing's syndrome. All granulosa tumors produce a variable degree of estrogenization and hypervolemia. Proliferation of "germinal" epithelium with formation of purposeless tubular structures is a conspicuous change in x-rayed ovaries. When grafted, these structures grow very slowly but progressively, giving rise to tubular adenomas. Ultimately all of these grafts with one exception, vanished either by overgrowth or transformation into granulosa cells. In the third successive passage one changed into, or was replaced by a rapidly growing adenocarcinoma with anatomical features of hypervolemia, but without estrogenization. Measurements of plasma volumes with I^{131} tagged homologous plasma and of cell volumes with P^{32} tagged erythrocytes indicate that hypervolemia by these two types of neoplasms is due to a

selective increase of plasma volumes, whereas the luteomas cause a selective rise of red cell volume. Correspondingly male mice have a higher red cell and female mice a higher plasma volume. Commonly, hypervolemia is associated with estrogen-secreting granulosa cells; but, as the present studies indicate, it is not caused by estrogen. Both types of neoplasms to which plethorin is related are believed to be derivatives of the germinal epithelium and thus far no other neoplasm was found with ability to cause hypervolemia. This specificity of plethorin production and its very nature require further study. (auth)

3178

SYMPOSIUM ON CEREBRAL PALSY. PART II. SOME EFFECTS OF IONIZING RADIATION AND METABOLIC INHIBITION ON THE DEVELOPING MAMMALIAN NERVOUS SYSTEM. Samuel P. Hicks. J. Pediat. **40**, 489-513(1952) Apr.

The developing nervous system in vivo, specifically its neuroblasts, has been found to be unusually susceptible to acute metabolic injury by ionizing radiation, certain sulphydryl reagents, other inhibitors and antimetabolites. It has been found relatively insensitive to acute interference with glucose and oxygen metabolism except late in development. In the first third of gestation the neural tube is resistant to radiation and possibly other agents but this period is in need of more investigation. Injuries in the latter two-thirds of gestation cause the development of progressive malformations of the nervous system during growth that carry over into adult life. The most important mechanisms that determine the form of the malformation are the actual destruction of building blocks (neuroblasts), and the time during gestation (critical period) at which the injury occurs. These experiments, which were carried out on experimental animals, chiefly rats and mice, invite attention to the possibility that a variety of agents may act during nervous system development to produce malformations. (auth)

3179

RADIATION-INDUCED LYMPHOID TUMORS OF MICE. Henry S. Kaplan. Acta Unio Intern. contra Cancrum **7**, 849-59(1952)

This paper presents results of current large-scale experiments on the effect of varying such factors as total x-ray dosage, number of treatments, and the interval between treatments (periodicity) upon both radiation mortality and the incidence of lymphoid tumors. Further studies on the mechanism of the induction process as related to local vs. whole-body radiation will also be reported, and the role of several other factors concerned with lymphoid tumor induction will be summarized. (auth)

3180

NUCLEIC ACIDS IN THE CANCEROUS CELL AND RADIO-SENSITIVITY. L. Cornil and A. Stahl. Acta Unio Intern. contra Cancrum **7**, 818-21(1952). (In French)

Observations made during Ra therapy by means of the Feulgen reaction in vitro and in vivo on lymphosarcoma cells with large nuclei and orthoplastic epitheliomas of the digestive tract, the cells of which have nuclei poor in thymonucleic acid and cytoplasm rich in ribonucleic acid, show that the radiosensitivity of a cell is proportional to its nucleoprotein content and that the radiosensitivity is directly proportional to the thymonucleic acid/ribonucleic acid ratio.

RADIATION HAZARDS AND PROTECTION

3181

Army Medical Research Lab., Fort Knox
A STUDY OF THE X-IRRADIATION PROTECTION
AFFORDED BY COBALT, by W. H. Parr, T. O'Neill, and
A. T. Krebs. Feb. 4, 1952. 8p. (AMRL-74; U21459)

White mice were maintained on a diet containing 3 to 4 mg Co/day for 5 to 8 days before and 15 days after 720-r whole-body irradiation. These animals showed an increase resistance to irradiation as compared to the group fed only Purina chow. The general appearance of the Co-fed irradiated animals was similar to that of the nonirradiated mice. (NRS abst.)

3182

Oak Ridge National Lab.
HEALTH PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING OCTOBER 20, 1951. Issued May 5, 1952. 26p. (ORNL-1174)

Methods of removal of Ce^{137} , Cd^{115} , and I^{131} from liquid waste are discussed. A study of the lime-soda softening process in the removal of Sr^{90} from water is reported. The level of radioactivity in bottom deposits and water samples from White Oak Creek and the Clinch and Tennessee Rivers was determined. Using gross β analysis the level of natural background activity in an uncontaminated spring in the White Oak Creek area was found to be $2.5 \times 10^{-7} \mu\text{c/cc}$. Progress is reported in ecological studies of the White Oak Creek region. Collision densities and energy losses of a monoenergetic beam of neutrons normally incident on an infinite slab of tissue of 30-cm thickness were calculated and data are presented in tabular form. The possibility of an ionization current caused by C recoil atoms in a graphite-lined chamber exposed to fast neutrons was investigated and tabular data are included. Experiments on the absorption of the internal-conversion electrons from Ba^{137} in various thicknesses of materials of several atomic numbers have been concluded and graphical data are given. Data from a series of airplane measurements over ground sources of Na^{24} , Co^{60} , Cs^{137} , Ra, and Ta^{182} made with NaI-crystal scintillometers indicate a buildup factor roughly proportional to the altitude. Radioisotopes are listed for which preliminary calculations of maximum permissible concentrations in total body, in air, and in water have been made to date.

3183

GERMAN ROENTGEN SOCIETY RULES FOR THE USE OF OPEN RADIOACTIVE PREPARATIONS (ESPECIALLY SYNTHETIC RADIOACTIVE ISOTOPES) IN MEDICAL WORK. B. Rajewsky. Fortschr. Gebiete Röntgenstrahlen **72**, 256-8(1952) Feb. (In German)

Twenty-five rules on transportation and storage of radioactive substances and working conditions and health precautions necessary to avoid ingestion of radioactivity are listed.

3184

THE EVALUATION OF WHITE-CELL COUNTING IN RADIATION PROTECTION. A. C. Chamberlain. F. M. Turner, and E. K. Williams. Brit. J. Radiology **25**, 169-76 (1952) April

In Part I the causes and extent of normal variations in the total white cell count, and the lymphocyte and neutrophil count, are considered. Physiological variations are very big, the coefficient of variation in an individual leucocyte count due to this cause over long periods being about 20 per cent. In Part II the variations to be expected from acute and chronic radiation are considered in relation to the other variations. Results in the literature are examined for evidence of discernible effects. It is concluded that white-cell counting does not give the measure of protection to an individual implied in the Recommendations of the British X-ray and Radium Protection Committee. There is, however, some evidence of detectable radiation effect on the average count of large groups of workers, even at the low levels maintained at the Atomic Energy Research Establishment. (auth)

3185

STUDIES ON FLASH BURNS; THE PROTECTIVE EFFECTS OF CERTAIN FABRICS. John H. Morton, Harry D. Kingsley, and Herman E. Pearse. *Surg. Gynecol. Obstet.* **94**, 497-501 (1952) Apr.

Studies of the effects of various fabrics and fabric combinations in protecting the skin of the anesthetized Chester White pig from flash burning were carried out. The effects of changing the color and of moistening certain of the fabrics were also tested. All fabrics afforded some protection but there was considerable variation in the extent of protection with different materials. It seemed that the color of the fabric was the single most important quality in determining the amount of skin protection. Light-colored fabrics were more protective than darker ones. The effect on the fabric itself was not a good indication of the changes in the animal's skin. In all experiments, burns occurred when there was no apparent damage to the surface of the material touching the animal. (auth)

3186

MASS TREATMENT OF BURNS IN ATOMIC WARFARE. Allyn J. McDowell. *Plastic and Reconstruct. Surg.* **9**, 223-34(1952) Mar.

Mass treatment of burns in an atomic explosion is considered as an unsolved problem which must be faced by the medical profession in attempting to provide a workable treatment plan integrated with other civil defense planning. Any intelligent plan, though it may prove to be impractical in many aspects, is better than resigning to futility. Preventive measures in the form of individual protective action may greatly minimize the problem. The problem is analyzed in terms of types and numbers of expected casualties and of facilities for treatment and evacuation in civil defense plans already adopted. Local wound care is singled out as the chief bottleneck in any mass treatment program for burns and the relative merits of the pressure dressing method and the exposure method are discussed at some length as the two most suitable methods. Other steps in initial burn treatment are discussed briefly and an over-all outline of treatment to provide reasonably acceptable care is discussed in general terms with estimates to indicate that it could be workable. Early classification of patients and supervision of treatment methods by qualified men previously authorized is considered essential. Skin grafting and late care of the burns as an almost separate program is dealt with briefly. (auth)

RADIATION SICKNESS

3187

Atomic Energy Project, Univ. of Rochester
THERAPY OF THE X-IRRADIATION SYNDROME WITH TERRAMYCIN, by Molly P. Coulter, Frank W. Furth and Joe W. Howland. *Apr. 2, 1952.* 13p. (UR-195)

In two separate experiments two groups of dogs were exposed to lethal dosage of 450 r of 250 kv x radiation. Following the irradiation one group was treated with clinical dosages of terramycin which resulted in a reduction in mortality from 12 of 13 in the controls to 7 of 14 in the treated animals. Treated animals did not show the delay in onset of symptoms previously noted in animals treated with aureomycin. Bacteriologic studies showed no apparent difference in the incidence of positive cultures between treated and control animals. Organisms recovered from the control animals were sensitive to terramycin; those from treated animals, resistant. No differences were noted in hematologic and pathologic observations in the two groups. Severe hemorrhage was the major cause of death observed at autopsy in both groups of animals. The probable action of terramycin in this reduction in mortality is discussed. (auth)

RADIOGRAPHY

3188

California Univ. Coll. of Dentistry
A RAPID RADIOAUTOGRAPHIC TECHNIQUE FOR COMBINED CALCIFIED AND SOFT TISSUES, by Howard M. Myers, Elizabeth Jennings and Hermann Becks. *California Univ. Coll. of Dentistry and George Williams Hooper Foundation for Medical Research.* [nd] 12p. (NP-3788)

The description of a rapid fixation-dehydration and embedding method has been given which can be employed to obtain very satisfactory combined radioautographs and roentgenograms from sections of soft and hard tissue (undecalcified). Some modifications of previous techniques have been developed which require minimal amounts of time with the view of applying them to studies with short-lived radioisotopes. (auth)

RADIOTHERAPY

3189

[Research Foundation, Ohio State Univ.]

THE USE OF COBALT 60 APPLICATORS IN THE TREATMENT OF CARCINOMA OF THE FEMALE GENITAL TRACT by Joseph L. Morton, Allan C. Barnes, Charles H. Hendrick, and George W. Callendine, Jr. [nd] 16p. (AECU-1978)

3190

RESULTS OF EXAMINATION OF 85 CASES OF THYROID CANCER WITH RADIOACTIVE IODINE. Robert Coliez, Maurice Tubiana, J. Dutreix, and J. Guelfi. *J. radiol. électrol.* **32**, 881-95(1951). (In French)

The results of external measurement and plotting of topographic charts of I^{131} uptake by the thyroids of 85 patients suggest the possibility of diagnosis of malign tumors. In some cases I^{131} uptake detected metastases which had escaped clinical and radiological examination. Treatment of 25 of the patients with therapeutic doses is outlined.

3191

THE DRAINAGE OF RADIOACTIVE SILVER COLLOIDS BY THE LYMPHATICS FOLLOWING INTRAPULMONARY ADMINISTRATION IN DOGS. P. F. Hahn, George Rouser, Houston Brummitt, Joseph Moorehead, and E. L. Carothers. *J. Lab. Clin. Med.* **39**, 624-8(1952) Apr.

Radioactive silver colloids have been administered to dogs by intrapulmonary route and have been shown to be concentrated by the lymphatic system draining the pulmonary region. The possible use of isotopes of this element in the treatment of carcinoma of the lung and bronchiogenic tumors is discussed briefly. (auth)

3192

ELIMINATION OF RADIOPHOSPHORUS IN CERTAIN NEOPLASTIC STATES. FIRST EXPERIMENTS WITH COLLOIDAL RADIOACTIVE CHROMIUM PHOSPHATE. André Herve and Jean Govaerts. *Acta Unio Intern. contra Cancrum* **7**, 841-8(1952). (In French)

Rates of elimination in the urine of P^{32} , injected intravenously in the form of H_3PO_4 solution, by patients with leukemia, polycythemia, lymphosarcoma, and Hodgkin's disease are reported. The rates found indicate that with therapeutic doses the amount of P^{32} fixed is not large enough to completely destroy tumors. The tissue distribution of colloidal P^{32} chromate has been studied in the rabbit; possible therapeutic application is indicated.

3193

RESEARCH ON THE POSSIBILITY OF ARTIFICIALLY OBTAINING VARIATIONS IN THE FIXATION OF RADIOISOTOPES IN LIVING TISSUE. II. ON THE ACTION OF IONOTOPHORESIS IN DEEP TISSUE. Gastone Meldolesi. *Radioterapia radiobiol. e fis. med.* **4**, 269-91(1951). (In Italian)

Details of attempts to concentrate radioactive ions, particularly P^{32} , in tissues by introduction of electrodes are

described. Damage to the tissue and other difficulties are discussed. Introduction of paramagnetic ions in vitro by a magnetic field did not result in concentration sufficient for radiotherapy. Eventual application of iontophoresis to internal radioisotope therapy is considered possible.

3194

RADIOLOGICAL USE OF HIGH ENERGY DEUTERONS AND ALPHA PARTICLES. Cornelius A. Tobias, Hal O. Anger, and John H. Lawrence. Am. J. Roentgenol. Radium Therapy Nucl. Med. 67, 1-27(1952) Jan.

The physical properties and isodose curves of 190-Mev deuterons have been described. It is shown that the deuteron beam has unique radiological properties: straight and deep penetration in tissue with small scattering and maximum dose near the end of the range of the beam. The deuteron beam is suitable for effective and intense irradiation of small volumes deep within the body of animals or humans. Detailed accounts of measurements of the ionization, range, stopping power and dosimetry of the ion beam are given. Methods for total and partial body irradiation of small animals are illustrated and results of the acute lethal effects and the effects of local irradiation of mouse tumors are described. Possible application to radiotherapy is pointed out. (auth)

3195

ESTIMATION OF DOSAGE FOR INTRAVENOUSLY ADMINISTERED P^{32} ; CALCULATION BASED ON TWO COMPARTMENT DISTRIBUTION OF THE ISOTOPE. Bertram V. A. Low-Beer, Robert S. Blais, and Norman E. Scofield. Am. J. Roentgenol. Radium Therapy Nucl. Med. 67, 28-41 (1952) Jan.

In Part I the distribution of intravenously administered P^{32} is discussed. It is shown that the differential concentration of intravenously administered radiophosphorus between soft tissues and bone-spleen-liver tissues makes it advisable to calculate the radiation dose in these two compartments separately. The dose in these two compartments is referred to as bone dose and soft tissue dose, respectively. Evidence is presented from experimental data which justifies the assumption that after a three day equilibration period the concentration ratio between the bone compartment and soft tissue compartment is 10:1. Taking into account the concentration changes in the first three days, this results in a bone to soft tissue dose ratio of 9:1. In Part II the charting of treatment and the practical use of special dose-record forms is presented. Part III deals with the derivation of the formulas used in the dose calculations based upon the two-compartment distribution of P^{32} . (auth)

3196

ON THE SUBJECT OF UNITS IN INTERNAL DOSIMETRY. A. Bru and P. Ferret. J. radiol. électrol. 32, 968-9(1951). (In French)

Advantages and disadvantages of the roentgen, curie, roentgen equivalent physical, energy unit (Gray), and gram roentgen (Mayneord) units in measuring internal radioisotope radiotherapy are discussed briefly.

3197

INTERNAL IRRADIATION OF ANTRAL AND MASTIOD CAVITIES. H. A. Hughes and R. H. Archer. Brit. J. Radiology 25, 152-3(1952) Mar.

A method of constructing 3-piece radioactive applicators for the irradiation of markedly re-entrant cavities is described.

TOXICOLOGY STUDIES

3198

Los Alamos Scientific Lab.
TOXICOLOGY OF ACTINIUM EQUILIBRIUM MIXTURE, by Wright Langham and John Storer. Feb. 20, 1952. Decl. Apr. 23, 1952. 15p. (AECD-3365; LADC-1153)

The acute toxicity of Ac^{227} equilibrium mixture was slightly less than that of americium and plutonium when administered intravenously to 150-g rats. The thirty day LD_{50} of actinium was $0.234 \mu\text{C}$ of α activity per gram body weight. That for americium and plutonium was 0.110 and $0.071 \mu\text{C}$ per gram body weight, respectively. Autoradiographic studies showed that the pattern of deposition of actinium in soft tissues was qualitatively similar to that of plutonium and americium. Detail autoradiographs confirmed the deposition of actinium in the perivascular areas of cortical bone. (auth)

3199

Los Alamos Scientific Lab.
ANTICHOLINESTERASE ACTIVITY OF TRIBUTYL PHOSPHATE, by Jean Captain Sabine and Francis Newton Hayes. [nd] 10p. (AECU-1954; LADC-1163)

Preparations of tributyl phosphate (TBP), both technical and reagent grades, are weak inhibitors of both major types of cholinesterase. Injection of large doses (1 ml per kilo) of TBP intraperitoneally to rats produced symptoms similar to doses of acetylcholine (ACh) from 25 to 75 mg per kilo. The symptoms from TBP were of longer duration than symptoms of equal severity produced by ACh. Symptoms from TBP not observed even with very large doses of ACh were sleepiness followed by coma. Oral and intramuscular administration of similar doses of TBP produced only mild, transient symptoms. It is concluded that the handling of TBP does not incur special hazards due to its anticholinesterase activity, and that precautions appropriate to organic solvents in general should give ample protection against this physiological property. (auth)

3200

BERYLLIUM AND GROWTH. II. THE EFFECT OF BERYLLIUM ON PLANT GROWTH. M. B. Hoagland. Arch. Biochem. Biophys. 35, 249-58(1952) Feb.

Experiments were undertaken to determine whether beryllium could replace magnesium in a growing organism. This was stimulated by the several known growth effects of beryllium in animals and by the fact that beryllium apparently competes with magnesium for animal alkaline phosphatases. The following findings are noted: (1) Beryllium can reduce the magnesium requirement of plants by some 60% within a certain range of magnesium deficiency. (2) The residual obligatory magnesium requirement is probably accounted for by chlorophyll since beryllium appears to have no primary effect on chlorophyll or chlorophyll production. (3) The pH of the nutrient solution is critical; at acid pH's, beryllium is highly toxic, and growth increase due to beryllium only appears at initial pH's above 11.2, although this initial pH rapidly falls to neutrality during the experimental period. (auth)

3201

CAGE-HOOD ASSEMBLY FOR SMALL ANIMALS. John T. Van Bruggen. Nucleonics 10, No. 3, 64-6(1952) Mar.

A C^{14} -metabolism cage-hood assembly for small animals, which minimizes $C^{14}O_2$ hazards and eliminates much of the odor and unsightliness associated with a group of mice or rats, is described.

TRACER APPLICATIONS

3202

Argonne National Lab.
SUMMARY OF CONFERENCE ON THE TOXICITY OF CARBON 14 HELD AT ARGONNE NATIONAL LABORATORY JANUARY 15-16, 1952, by A. M. Brues and D. L. Buchanan. Mar. 1952. 14p. (ANL-4787)

This summary of a conference on the toxicity of C^{14} covers discussions of inorganic C, organic C compounds, routes of excretion of various non-physiologic C compounds, theoretical aspects of C turnover, toxicity studies, a résumé of C^{14} retention, and low-level counting methods.

3203

Brookhaven National Lab.

ALLOXAN DIABETES AND PHOSPHATE TURNOVER IN THE LIVER, by Jacob Sacks. [nd] 17p. (BNL-1138)

The effect of alloxan diabetes on the composition of the acid-soluble P of the liver and its turnover have been studied in two strains of rats. The principal changes from normal that were found were an increase of about 50 percent in the concentration of inorganic phosphate, and decreases of about one-third in the concentrations of ATP-ADP, glucose-1-phosphate, and glucose-6-phosphate. The distribution of the tracer phosphate between the bone and soft-tissue compartments was found to be the same in the diabetic animals as in the normal. The rate constants of the processes which remove tracer phosphate from the plasma were found not to differ from the normal in the diabetic animals. Indications were obtained of a lower turnover rate of the labile P of ATP-ADP and of glucose-1-phosphate in the diabetic animals. No evidence was found that might suggest a qualitative change in the operation of the phosphorylation cycle, that might account for the metabolic defect in diabetes. The changes found, both in composition of the acid-soluble P and the rate constants of the turnover, seem disproportionately small in relation to the profound alterations in carbohydrate metabolism of the diabetic state. (auth)

3204

Radiation Lab., Univ. of Calif.

METABOLISM OF RADIOACTIVE CHOLESTEROL IN THE INTACT RAT, by David Kritchevsky, Martha R. Kirk, and Max W. Biggs. Apr. 4, 1952. 11p. (UCRL-1748)

Studies on the metabolism of exogenous cholesterol in the intact rat, using cholesterol labeled with carbon-14 and hydrogen-3, are described. In the case of both cholesterol-C¹⁴ and cholesterol-H³ feeding, radioactivity was present in the urine and in the fatty acid and non-saponifiable portions of the feces, carcass, adrenals and liver. In the case of the rats fed cholesterol-C¹⁴, activity was also present in the breath, liver phospholipid and liver glycogen. In the case of one pregnant animal, 20% of the administered activity was present in the fetuses. (auth)

3205

Atomic Energy Project, Univ. of Rochester

THE EFFECT OF AGE ON RECRYSTALLIZATION OF BONE MINERAL, by W. F. Neuman and B. J. Mulryan. Mar. 26, 1952. 10p. (UR-193)

In an attempt to demonstrate that the rate of recrystallization of bone mineral decreases with increasing age of the animal, rats of three age groups were injected with radio-phosphate. At varying time intervals after injection, animals were sacrificed; their femurs were removed, ground and fat-extracted. Powdered specimens of these bones were then placed in inert phosphate buffer to determine the amount of radioactivity desorbable. In confirmation of earlier work, the amount of desorbable radiophosphate declined with increasing time in the animal and the rate of decline was most rapid in the youngest animals suggesting that the rate of recrystallization of bone mineral does indeed decrease with age. These conclusions must be regarded as tentative, however, because of several uncontrolled variables in the experiments. (auth)

3206

THE ACTION OF SALTS OF ZIRCONIUM AND OTHER METALS ON PLUTONIUM AND YTTRIUM DISTRIBUTION AND EXCRETION. Marcia R. White and Jack Schubert. J. Pharmacol. Exptl. Therap. 104, 317-24(1952) Mar.

Treatment of rats with zirconium prior to injection of Pu²³⁹ and Y⁹¹ lowered the amount of Pu and Y subsequently deposited in the skeleton and increased the amount of Pu in the kidneys. The deposition of both Pu and Y in the bone was correlated with the length of time between pretreatment and

their injection. Zr injected 24 hours after Pu and Y prevented further deposition of the radioelements in bone, but had no other observable effect on their organ distribution. In addition to Zr other hydrolyzable elements—manganese, iron, titanium, aluminum, and thorium—reduced bone deposition of Pu, but had various effects on the amounts deposited in other organs. Al and Th increased the Pu content of the liver and other soft tissues. Non-hydrolyzable magnesium had no significant effect on the distribution of either Pu or Y. The mechanism by which salts of Zr and other hydrolyzable elements may affect Pu and Y metabolism is discussed. This includes adsorption of the radioelement on colloidal aggregates in the circulation and the relation between particle size and the resulting distribution of the aggregate plus adsorbed radioelement. (auth)

3207

A TRACER STUDY OF THE METABOLISM OF p-iodo-PHENYL URETHANE; THE SELECTIVE LOCALIZATION OF RADIOACTIVE MATERIAL. Joan Crick and Harold Jackson. Brit. J. Pharmacol. 7, 142-51(1952) Mar.

The preparation of N-p-iodophenyl ethyl carbamate labeled with radioiodine is described. A preliminary examination has been made in rats of the tissue distribution of radioactivity after oral and intraperitoneal administration of this substance; a similar study has been carried out with labeled iodoaniline. Both substances show an initial rapid metabolic phase during the first 24 hr with transient concentrations of varying extent in the major tissues—kidneys, brain, and liver. No such effects were observed in other tissues, including muscle, lung, thymus, and gonads. A remarkable concentration of radioactivity develops in the cellular elements of the blood—probably the red cells only—which is associated in its earlier stages with methemoglobinemia. However, this localization of radioactivity persists long after visible methemoglobinemia has disappeared; the spleen shares in this activity, but on a somewhat smaller scale. Other tissues are then virtually free from radioactivity. This localization of activity occurs with both the substances referred to above. It is likely that N-p-iodophenyl ethyl carbamate undergoes hydrolysis in vivo to produce iodoaniline; this in turn is converted to another agent which presumably enters the erythrocyte and is fixed by some cellular component. The metabolism of phenyl urethane is not accompanied by any visible methemoglobinemia even in sublethal doses. (auth)

3208

SELECTIVE ACCUMULATION OF FLUORESCENT AND RADIOACTIVE DYES IN TUMOR TISSUE AS THE BASIS OF A NEW TYPE OF CANCER DIAGNOSIS. Hans Cramer, Wather Stich, and Alfred Treibs. Naturwissenschaften 39, 137-8(1952) Mar. (In German)

A series of I¹³¹-labeled porphyrins—protoporphyrin, coproporphyrin, uroporphyrin, hematoporphyrin, deuteroporphyrin, and diiododeuteroporphyrin—were shown to concentrate in neoplastic tissues in rabbits with Brown-Pearce tumors. Selective concentration in human malign tumors, lymphogranulomatosis, leukemia, etc., or increased excretion by patients with respect to normal humans were noted with various I¹³¹-labeled fluorescent dyestuffs of the acridine series, such as acridine orange, atebrin, etc., Na fluorescein and eosin.

3209

DISTRIBUTION OF RADIOPHOSPHORUS IN THE LONG BONES OF ADULT RABBITS. P. Lacroix, R. Devis, and E. Schicks. Experientia 8, 113-4(1952) Mar.

Studies on the specific activity of the epiphyses of the long bones of fully grown rabbits as compared with that of the diaphyses, after the administration of radiophosphorus, are described. Large doses of radiophosphorus were used so as to recover a fairly good activity in the smallest por-

tions of the bones, even after 76 days. Up to the 76th day the phosphorus specific activities of the epiphyses and of the diaphyses do not show any tendency to be reduced to uniform activities.

- 3210
DISAPPEARANCE RATE OF TAGGED SUBSTANCES FROM THE CIRCULATION OF ROENTGEN IRRADIATED ANIMALS. Leon Wish, Jacob Furth, Charles W. Sheppard, and Robert H. Storey. *Am. J. Roentgenol. Radium Therapy Nucl. Med.* 67, 628-40(1952) Apr.

The disappearance rate of labeled homologous and heterologous plasma, homologous and heterologous erythrocytes, Evans blue, and radiogold was studied in rabbits and mice. It was found that one day after irradiation all of these substances disappeared faster from the circulation of irradiated than from that of normal animals. These results are interpreted, in the light of other observations, as indicating a heightened capillary permeability caused by irradiation. Phagocytic activity by macrophages is enhanced in x-irradiated animals because of greater demand, but phagocytic affinity does not appear to be significantly altered. The extraordinary rapidity of phagocytosis of intravenously injected particles is demonstrated by radioisotope methods. The rapid breakup of foreign erythrocytes within reticulo-endothelial cells is quantitated by measurements of the loss of P^{32} activity from the tagged erythrocytes. (auth)

CHEMISTRY

- 3211
Illinois Univ.
REPORT FOR THE PERIOD OCTOBER 21, 1950 TO OCTOBER 20, 1951 AND PROPOSED PROGRAM AND BUDGET FOR THE PERIOD FEBRUARY 1, 1952 TO JANUARY 31, 1953, by Peter E. Yankwich. [nd] 55p. (AECU-1957)
In preparation for a study of irradiation products of nitrogeneous substances in which the reaction $N^{14}(n,p)C^{14}$ was expected to take place, a procedure for analyzing mixtures of CO_2 , CO , CH_4 , HCN , formaldehyde, methanol, and formic acid was developed. The gaseous compounds were removed by aeration; the HCN was precipitated with $AgNO_3$; and the formaldehyde, methanol, and formic acid were separated by a combination of oxidation and distillation techniques. The exchange reaction between free carbonate-bicarbonate and carbonato-bisethylenediamine-cobalt(III) complex ion has been explored. Concentration, temperature, and rate data are tabulated for eight runs. In preliminary experiments the carbonate complex was resolved into its optical isomers. It was found that the racemization and exchange reactions do not have a common rate-determining step, and that the uptake of hydroxide by the complex involves an addition rather than a substitution. The isotope effects in the decarboxylation of malonic acid and bromomalonic acid have been redetermined with C^{14} labeling. The results are in partial agreement with earlier similar experiments; and C^{14} effect is larger than that predicted from the C^{13} effect.

- 3212
Illinois Univ.
REPORT FOR THE PERIOD FEBRUARY 1, 1950 TO OCTOBER 20, 1950 AND PROPOSED PROGRAM AND BUDGET FOR THE PERIOD FEBRUARY 1, 1951 TO JANUARY 31, 1952, by Peter E. Yankwich. [nd] 21p. (AECU-1958)
3213
Los Alamos Scientific Lab.
KINETICS ANALYSIS OF FLOW CATALYSIS OF ORTHO TO PARA HYDROGEN, by J. D. Rogers. [nd] 9p. (AECU-1972)

Kinetics equations for both single- and dual-site mechanisms in the catalytic conversion of ortho hydrogen are given and discussed. Application of these equations to data collected by E. R. Grilly indicates that the reaction is monomolecular in both directions and reversible with reaction on the catalyst surface controlling the rate. Comparison of two chrome-alumina catalysts indicates a twofold difference in activities.

- 3214
Notre Dame Univ.
THE KINETICS OF HOT HYDROGEN ATOMS IN THE PHOTOLYSIS OF THE HYDROGEN HALIDES (thesis), by Harold A. Schwarz. Nov. 1951. 55p. (AECU-1984)
The photolyses of hydrogen iodide, deuterium iodide, and hydrogen bromide were studied in the presence of inert gases. The inhibition effect of the free halogens was found to be a function of the inert gas concentration, the effect being independent of the nature of the inert gas being used at infinite inert gas pressure. The results are interpreted in terms of hot atom mechanisms and values found for various rate constants involved. The moderation effect of the inert gas is accounted for semi-quantitatively, and the moderation constants of the various gases related by the theory used. An activation energy difference between the thermal reactions $H + HI \rightarrow H_2 + I$ and $H + I_2 \rightarrow HI + I$ is found to be $E_1 - E_2 - 4.5 - 0.8$ kcal per mole. (auth)
3215
Argonne National Lab.
MECHANISM OF THE γ -RAY INDUCED CHAIN OXIDATION OF AQUEOUS FERROUS SULFATE-FORMIC ACID-OXYGEN SOLUTIONS, by Edwin J. Hart. Mar. 18, 1950. 20p. (AECU-1998; UAC-540)
A study has been made of the effect of ferrous sulfate, formic acid and oxygen concentration on the rate of the γ -ray-induced oxidation in the system: ferrous sulfate-formic acid-oxygen. The oxidation of ferrous sulfate proceeds by a chain oxidation yielding up to 42 ferric ions per initiating radical. The results are discussed in terms of a mechanism involving free hydrogen atom and hydroxyl radical-induced initiation steps. These reactions are followed by five propagation steps. Hydrogen peroxide is an intermediate in one of the propagation steps, and termination occurs by reactions between some of the free radical species and the ferrous and ferric ions. (auth)

- 3216
Argonne National Lab.
HEATS OF SOLUTION OF THE COBALTOUS NITRATE HYDRATES IN WATER AND IN CERTAIN ORGANIC SOLVENTS, AND BINDING ENERGIES OF MOLECULAR LIGANDS, by Leonard I. Katzin and John R. Ferraro. Apr. 1951. Decl. Apr. 24, 1952. 32p. (AECU-3353)
Heats of solution have been measured for the hexahydrate, tetrahydrate, trihydrate and dihydrate of cobaltous nitrate in water and in a series of organic solvents, including isobutyl alcohol, diethyl- and monoethyl ether of ethylene glycol, acetone, methyl ethyl ketone, tetrahydrofuran, tributyl phosphate and dimethyl formamide. For some solvents, where the solubility of the salt or its reaction product was insufficient, measurements were made in admixture with acetone. Such solvents include diethyl ether, tetrahydrofurfuryl alcohol, and pyridine. Measurements were also made with mixtures of the other solvents cited and acetone. In the cases of pyridine, water, tetrahydrofurfuryl alcohol and isobutyl alcohol, evidence is found for a transition from a probably tetrasolvated neutral molecule in solution to a hexasolvated entity, frequently of lowered solubility. The solvents can be arrayed in order of base strengths on the basis of the heat measurements, and it is possible to estimate energies of binding of solvent groups by the metal atom. As a check on

these, some measurements of the heats of solution of some cobaltous nitrate pyridinates are also presented. (auth)

3217

Los Alamos Scientific Lab.

THERMODYNAMIC PROPERTIES OF AIR. William D. Baker, comp. [nd] Decl. Apr. 23, 1952. 5p. (AECD-3366; LADC-1133)

3218

National Bureau of Standards

HEAT OF REACTION OF DIBORANE WITH WATER, by Edward J. Prosen, Walter H. Johnson, and Florence Y. Pergiel. Mar. 26, 1952. 14p. (NBS-1552; U21568)

Complete hydrolysis of B_2H_6 was obtained by bubbling it through 2 bubblers in series in a calorimeter. The reaction was: $B_2H_6 + 6H_2O \rightarrow 2H_3BO_3$ (aqueous) + $6H_2$. The calorimetric system was calibrated by means of electrical energy. The ΔH at $25^\circ C$ was -111.46 ± 0.54 kcal/mole. Combination of this value with that reported for the heat of decomposition of B_2H_6 and the heat of solution of B_2O_3 makes the $\Delta H(25^\circ C)$ of crystalline B_2O_3 formed from amorphous B and gaseous O equal to -306.11 ± 0.75 kcal/mole. (NRS abst.)

3219

Northwestern Univ.

REACTIONS OF ALKANES WITH HYDROGEN AND DEUTERIUM; RACEMIZATION AND EXCHANGE, by Robert L. Burwell, Jr. and Warren S. Briggs. Mar. 1, 1952. 32p. (NP-3719; Technical Report No. 3; U21390)

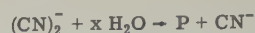
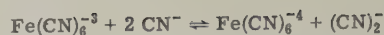
In the presence of an Ni-kieselguhr catalyst at about 90 to $130^\circ C$, heptane, 3-methylhexane (I), 3,3-dimethylhexane (II), and 2,2,3-trimethylbutane (III) exchange with D. The relative number of molecules exchanged under equivalent conditions decreased from 1.00 to 0.75, 0.36, and 0.13 from heptane to I, II, and III, respectively. The relative abundance of the various exchanged species was determined by mass spectroscopy. All possible exchanged species were present in heptane and I; the more exchanged species were weighted more heavily than corresponded to statistical equilibrium. Up to 7 exchanged H atoms were found in II and III. The exchange process apparently did not propagate beyond quaternary C atoms. The racemization rate in I was substantially independent of the extent of exchange. The ratio of the number of molecules exchanged to those racemized was about 1.6. Within the range studied, the racemization rate was represented by $k_0 \exp(-26,000/RT) P_{H_2}^{0.6} P_{3MH}^{1/2}$. In the absence of H, the catalyst became poisoned. (cf. TIP U17359) (NRS abst.)

3220

University of Southern Calif.

ELECTRON TRANSFER PROCESS AND THE REDOX REACTIONS OF HEXACYANOFERRATE(III) ION IN AQUEOUS SOLUTION, by Arthur W. Adamson. [nd] 21p. (NP-3720; U21587)

The rates for 0.05 to 0.206M KCN in $Fe(CN)_6^{3-}$ were obtained by iodometric titration of the complex. Most runs were made with 1M KCl as an ionic-strength buffer and with KCN half-neutralized with HCl to buffer the pH. $ZnSO_4$ was used to precipitate the cyanide and the $Fe(CN)_6^{2-}$ which formed when KI was added. Most rate measurements were made with a spectrophotometer. The absorption spectra for the 2 complex ions agreed with those reported by Ibers and Davidson (*J. Am. Chem. Soc.* 73, 476(1951)). The redox reactions of $Fe(CN)_6^{3-}$ were rapid when the process involved a simple electron transfer but slow and complex if the transfer failed to occur. In general, reactions of the first type and 1-electron-transfer exchange processes followed a correlation based on the magnetism (or net angular momentum) of the ions. The kinetics of the oxidation of the CN^- indicated the following mechanism:



where P and Q are intermediate species. (cf. TIP U14020) (NRS abst.)

3221

CRYOSCOPIC STUDY OF SOLUTIONS OF CERTAIN METALLIC OXIDES IN THE CRYOLITE-SODIUM FLUORIDE EUTECTIC. Georges Petit. *Compt. rend.* 234, 1281-3 (1952) Mar. 17. (In French)

Cryoscopic curves of La_2O_3 , ThO_2 , Al_2O_3 , BeO , B_2O_3 , CaO , and CeO_2 in the Na_3AlF_6 -NaF eutectic (m.p. $885^\circ C$, cryoscopic constant 27) are presented and compared with those in pure cryolite (m.p. $1008^\circ C$). Dissociation is not so complete as in the latter solvent; La_2O_3 producing only three particles presumably $2LaO^+$ and O^{2-} . BeO and B_2O_3 do not dissociate, CaO , Al_2O_3 , and CeO_2 dissociate only with difficulty, and the ThO_2 dissociation varies with dilution, in sharp contrast to the case in cryolite.

3222

CRITICAL POTENTIAL OF PROTACTINIUM DEPOSITION ON VARIOUS METALS. Jacques Danon and Christiane Ferradini. *Compt. rend.* 234, 1361-3(1952) Mar. 24. (In French)

Carrier-free 27.4-day Pa^{233} at a concentration $\sim 10^{-11}M$ in 1N NaF was electrodeposited on various metals. Extrapolation of the curves of total deposited activity as a function of voltage to zero activity gave the following critical potentials: Pt, -1.45; Au, -1.43; Ag, -1.45; Cu, -1.46; Ni, -1.14. Reproducibility was satisfactory, with occasional deviations noted for Ag.

3223

CRYOSCOPY IN MOLTEN LITHIUM BORATE. CRYOSCOPIC OF THE FLUORIDES. Georges Zarzycki. *Compt. rend.* 234, 1370-1(1952) Mar. 24. (In French)

The cryoscopic curves of LiF, NaF, KF, BeF_2 , MgF_2 , CaF_2 , SrF_2 , BaF_2 , ZnF_2 , CdF_2 , PbF_2 , AlF_3 , and Na_3AlF_6 in molten $LiBO_2$ are presented. All these fluorides are completely dissociated, even the cryolite having the molar depression of 10 particles.

3224

THE EFFECT OF THE ELEMENTS OF THE FIRST LONG PERIOD ON THE $\alpha \rightleftharpoons \beta$ TRANSFORMATION IN TITANIUM. A. D. McQuillan. *J. Inst. Metals* 80, 363-68(1952) Mar.

The method in which the hydrogen pressure in equilibrium with an extremely dilute solution of hydrogen in a titanium-rich alloy is measured as a function of temperature in order to follow the phase transformations occurring in the alloy, described in a previous paper (*J. Inst. Metals* 79, 73 (1951)), has been used for a systematic investigation of the effects of vanadium, chromium, manganese, nickel, and cobalt on the $\alpha \rightleftharpoons \beta$ transformation in titanium. The maximum amount of each addition element used was approximately 5 at. %. It is found that all these elements, when added to titanium, depress the allotropic transformation, and that, with the exception of vanadium, they are not appreciably soluble in the low-temperature (α) form of titanium. The extent of the depression of the $\beta/(\alpha + \beta)$ boundary is substantially the same for equal atomic fractions of all the addition elements, except in the case of vanadium, which is slightly less effective in this respect than the others. The experimentally determined $\beta/(\alpha + \beta)$ boundaries have been compared with an idealized theoretical boundary obtained from the known latent heat of transformation of pure titanium. The experimental data have been used to determine the effect of addition elements on the hydrogen solubility in

β -titanium. Vanadium caused the greatest change in this property, the other elements having but little effect. (auth)

3225

INVESTIGATION OF THE COLORED COMPLEX OF TITANIUM WITH HYDROGEN PEROXIDE. A. K. Babko and A. I. Volkova. *Zhur. Obshchei Khim.* **21**, 1949-56(1951) Nov. (In Russian)

The colored complex present in the $[H^+]$ region 0.3N to 6N was found to be $[TiH_2O_2]^{+4}$ with a dissociation constant of 0.9×10^{-4} . At and above pH 5 a colorless complex of Ti with HO_2^- or O_2^{2-} exists.

3226

FLUORIDE COMPLEXES OF TITANIUM IN SOLUTION. K. E. Kleiner. *Zhur. Obshchei Khim.* **22**, 17-23(1952) Jan. (In Russian)

The F-containing complex of Ti in HNO_3 and H_2SO_4 solutions with NaF concentrations of $2.5 \times 10^{-5}M$ to 0.12M was shown to have a F:Ti ratio of 1:1. It presumably has the formula $TiOF^+$. The dissociation constant $[TiO^{++}][F^-]/[TiOF^+]$ was found to be 3.6×10^{-7} . The equilibrium constant of the equation $TiOF^+ + H_2O_2 \rightleftharpoons TiOH_2O_2^{++} + F^-$ was calculated to be 3.6×10^{-3} .

3227

ANHYDROUS LITHIUM METANILOBATE. A. V. Lapitskiĭ. *Zhur. Obshchei Khim.* **22**, 38-41(1952) Jan. (In Russian)

Two methods of preparing anhydrous $LiNbO_3$ from Li_2O and Nb_2O_5 are described. The melting point was found to be $1164 \pm 2^\circ C$, and the specific weight was 4.283 or 4.308 depending on the preparation method.

3228

THE EVAPORATION COEFFICIENT OF POTASSIUM BETWEEN 66 AND $111^\circ C$. Kurt Neumann and Kurt Schmoll. *Naturwissenschaften* **39**, 131-2(1952) Mar. (In German)

The following values of the coefficient α in Knudsen's equation, $dn/dt = \alpha p/(2\pi m k T)^{1/2}$, for the evaporation of a liquid in vacuum were determined for liquid K by a hanging-drop method.

| Temperature, $^\circ C$ | α |
|-------------------------|-----------------|
| 66.6 | 1.03 ± 0.05 |
| 66.7 | 1.05 ± 0.05 |
| 104.5 | 1.01 ± 0.05 |
| 111.0 | 1.00 ± 0.05 |
| 111.2 | 0.95 ± 0.05 |

ANALYTICAL PROCEDURES

3229

Babcock and Wilcox Co.
THE DETERMINATION OF CARBON IN SODIUM-POTASSIUM ALLOYS, by Kenneth G. Stoffer and J. H. Phillips. Nov. 20, 1950. Decl. June 1, 1950. 32p. (NP-3722; Report No. ES401-14; R&D-5036; U62448)

A method has been described for the determination of carbon in sodium-potassium alloy. It is a modification of the classical microcombustion method and involves the ignition of a 100 mg sample at very high temperatures to decompose all carbon compounds which might be present. The carbon is converted to CO_2 which is absorbed and weighed. Results are accurate within tolerances acceptable in microcombustion analysis. The method described also covers the problem of sampling hot Na-K from a dynamic system, weighing it, and transferring it to the analytical apparatus by means of specially designed equipment. The possibility of analyzing for hydrogen simultaneously with carbon is considered. (auth)

3230

Institute of Science and Tech., Univ. of Arkansas
BIBLIOGRAPHY OF DIFFERENTIAL THERMAL ANALYSIS,

by W. J. Smothers, Yao Chiang, and Allan Wilson. Nov. 1951. 44p. (NP-3774)

The 165 references in this bibliography are preceded by a brief review of the development of the differential thermal method, the equipment required, the variables involved, and the use of the method. The references are arranged in chronological order from 1887 to 1950. Author and subject indexes are included.

3231

Department of Mines and Technical Surveys (Canada)
THE DETERMINATION OF URANIUM IN ORES; FLUOROPHOTOMETRIC METHOD; A PROCEDURE FOR THE REMOVAL OF INTERFERING CERIUM, by J. B. Zimmerman and R. J. Guest. Feb. 21, 1952. 13p. (NP-3789; TR-96/52)

The fluorescence of Ce in a flux of NaF interferes with the analysis of U in a flux of NaF by the fluorimetric method. A rapid procedure is described for preventing the interference due to Ce by the separation of U from reduced Ce by ethyl acetate extraction of U. The effect of H_2O_2 and HNO_3 concentration on the extraction of U by ethyl acetate is determined.

3232

Pennsylvania State Coll.
POLAROGRAPHIC BEHAVIOR OF ORGANIC COMPOUNDS; XIV. EFFECT OF ALKOXYL GROUP ON CARBON-HALOGEN BOND FISSION, by Philip J. Elving, Ching-siang Tang and Isadore Rosenthal. Sept. 1, 1951. 6p. (NYO-847; Report No. 2)

The methyl, ethyl, and n-butyl monochloroacetates were investigated in buffered and unbuffered solutions. The half-wave potentials for fission of the carbon-halogen bond are pH-independent. The nature of the reduction mechanism is discussed. (auth)

3233

ON THE OXIDATION REACTION OF TRIVALENT ARSENIC BY PENTAVALENT VANADIUM. Ghislain Gaudetroy. *Compt. rend.* **234**, 1171-3(1952) Mar. 10. (In French)

Studies on the oxidizing power of V(V) in various mineral and organic substances led to investigation of the action of vanadic anhydride, V_2O_5 , on arsenious acid in H_2SO_4 . The oxidation is favored by excess of V(V), high acidity, presence of H_3PO_4 , and high temperature. The catalytic effect of I is marked. The process may be used to determine As_2O_3 .

3234

STANNOMETRY. VOLUMETRIC DETERMINATION OF IRON(III), VANADATE, DICHROMATE, IODATE, BROMATE, FERRICYANIDE IONS AND IODINE. Zoltán G. Szabó and Edith Sugár. *Anal. Chim. Acta* **6**, 293-315(1952) Apr. (In English)

A generally applicable reductive method is elaborated by means of which numerous substances can be determined having oxidation potentials exceeding 0.3 v. The 0.1N stannous chloride standard solution can be stored for some months, with a very slight decrease in titer, by using an automatic equipment for supplying with CO_2 the storage flask and burette. The procedure has so far been employed for the determination of ferric, ferrous, dichromate, vanadate, bromate, iodate, and ferricyanide ions, and furthermore of iodine. The advantage of the method is, in addition to its simplicity, that in the ranges given the experimental error never exceeds 0.5%. (auth)

3235

THE ALKALIMETRIC DETERMINATION OF ALUMINIUM. Michael Beck and Zoltán G. Szabó. *Anal. Chim. Acta* **6**, 316-21(1952) Apr. (In English)

To determine Al^{+3} the titration is carried out from the alkaline side, and two measurements are performed. An

aliquot of the aluminate stock solution is titrated with 0.1N HCl until complete precipitation of $\text{Al}(\text{OH})_3$, indicated by the color change of neutral red. Another aliquot of the stock solution is mixed with alkali fluoride and titrated to the same pH. The difference between the two titrations multiplied by 0.899 gives the amount of Al^{+3} in milligrams. (auth)

3236

TRIVALENT MANGANESE AS AN OXIDIMETRIC REAGENT. R. Belcher and T. S. West. *Anal. Chim. Acta* **6**, 322-32(1952) Apr. (In English)

A study of the use of trivalent Mn as an oxidimetric reagent has been made. The manganic ion was stabilized with pyrophosphate. The stability of this reagent over a period of 6 weeks was established. The reagent may be used in conjunction with barium diphenylamine sulphonate for the titration of ferrous iron even in the presence of 5N HCl. It may also be used for the titration of vanadium, nitrite, oxalate, peroxide and arsenite, but the procedures for oxalate and peroxide are unsatisfactory. The redox potential of the reagent was 1.22 v at 25°C, which was lower than that found for manganic sulfate (~1.4 v). (auth)

3237

SPECTROPHOTOMETRIC DETERMINATION OF VANADIUM BASED ON THE ABSORPTION PROPERTIES OF THE BLUE VANADYL ION. Rafael Santini, Jr., J. F. Hazel, and Wallace M. McNabb. *Anal. Chim. Acta* **6**, 368-72(1952) Apr. (In English)

The spectrophotometer has been applied to the colorimetric determination of V on the semi-micro scale by employing the absorption properties of the blue vanadyl ion. Vanadate solutions are acidified and reduced with SO_2 to the vanadyl state. The blue color is stable in H_2SO_4 up to 10N and in HCl less than 1N. The color is not stable in HNO_3 or H_3PO_4 . Small amounts of ferrous, chromic, and uranyl ions do not interfere. The method is rapid and the accuracy is good in the concentration range 0.5 to 3.0 mg of V/ml. (auth)

3238

INVESTIGATION OF THE FORMS OF PHOSPHORUS IN NEUTRON-BOMBARDED PHOSPHATES. III. SUPERPHOSPHATE AND CALCIUM SULPHATE HEMIHYDRATE. J. G. A. Fiskell, W. A. DeLong, and W. F. Oliver. *Can. J. Chem.* **30**, 185-93(1952) Mar.

Carrier-precipitation and serial molybdate precipitation procedures for the identification and estimation of chemical forms of P are presented in some detail. Application of these methods to the investigation of the forms of P^{32} in superphosphate and calcium sulphate after neutron bombardment is described. The results obtained indicated that about 40% of the P^{32} in the superphosphate was in the orthophosphate form and that the greater part of the remainder was present as metaphosphate and phosphite. Approximately 90% of the radioactive P present in the CaSO_4 was estimated to be in the orthophosphate form. The amount of P^{32} in the superphosphate originating from the CaSO_4 component was estimated to be less than 0.2%. (auth)

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

3239

MODERNIZATION OF MENDELEEV'S PERIODIC SYSTEM OF THE ELEMENTS. N. P. Agafoshin. *Zhur. Obshchei Khim.* **22**, 177-84(1952). Feb. (In Russian)

A circular form of the periodic system is described. Sectors represent groups, and a given radial distance represents the particular electron shell being filled.

3240

THE PLACE OF THE SYNTHETIC ELEMENTS IN THE PERIODIC SYSTEM. Charles D. Coryell. *Record Chem. Progress* (Kresge-Hooker Sci. Lib.), 55-64(1951) Spring.

The history of the synthetic elements and their conformation to the periodic table are reviewed and discussed. It is found that only the elements Cm, Bk, and Cf fall smoothly in the framework of expectations for homologs of the lanthanide series. Beginning with Pu, the transuranium elements show the trivalent state as the principal one. 29 references.

DEUTERIUM AND DEUTERIUM COMPOUNDS

3241

Brookhaven National Lab.

EQUILIBRIUM IN THE EXCHANGE OF DEUTERIUM BETWEEN AMMONIA AND HYDROGEN, by Morris Perlman, Jacob Bigeleisen and Norman Elliott. [nd] *Decl. Apr.* **23**, 1952. 13p. (AECD-3360; BNL-1007)

Equilibrium in the reaction $\text{NH}_3(\text{g}) + \text{HD}(\text{g}) = \text{NH}_2\text{D}(\text{g}) + \text{H}_2(\text{g})$ was measured in the temperature range 210 to 295°K. The results may be expressed by the relation $K = 0.955 \exp(512/T)$. The zero point energy difference between NH_3 and NH_2D is calculated to be $637 \pm 3 \text{ cm}^{-2}$. (auth)

3242

ON THE POLARIZABILITY OF THE HYDROGEN MOLECULE. By Eiichi Ishiguro, Tadashi Arai, Masataka Mizushima, and Masao Kotani. *Proc. Phys. Soc. (London)* **65A**, 178-87(1952) Mar. 1.

The polarizability of the H_2 molecule is calculated theoretically. The energy of the molecule, under an external electrostatic field, is calculated by the variation method, using 11 + 10 terms and 11 + 9 terms James-Coolidge type wave functions, for the polarizability parallel to and perpendicular to the molecular axis respectively. By expanding the energy in powers of the field strength, the polarizability is determined. By using a Morse function for the adiabatic potential of the molecule, the 0-0 and 0-1 matrix elements of the polarizability between vibrational states are calculated, with the result: $\alpha_{00} = 7.89$, $\gamma_{00} = 2.78$, $\alpha_{01} = 1.39$, $\gamma_{01} = 0.90$ for ordinary hydrogen H_2 , and $\alpha_{00} = 7.75$, $\gamma_{00} = 2.68$, $\alpha_{01} = 1.13$, $\gamma_{01} = 0.71$ for heavy hydrogen D_2 (in units of 10^{-25} cm^3), where α is the mean polarizability and γ the anisotropy. (auth)

3243

THE DIELECTRIC PROPERTIES OF HBr AND DBr IN THE SOLID STATE. J. G. Powles. *J. phys. radium* **13**, 121-33(1952) Mar. (In French)

The dielectric properties of solid HBr and DBr were measured from 70 to 145°K and from 80 cps to 20 Mc. A second h-f domain of dispersion was found. The curve of critical frequency as a function of temperature permitted energies of activation and potential-barrier heights opposing orientation of the molecules with the field to be determined. At low frequencies the dispersion curve for HBr was aberrant, whereas that for DBr was normal. This is attributed to a rotation tunnel effect present in HBr but negligible in DBr because of the H-D mass difference.

FLUORINE AND FLUORINE COMPOUNDS

3244

Carbide and Carbon Chemicals Co. (K-25)

REACTION OF FLUORINE WITH STEAM AT ELEVATED TEMPERATURES, by C. R. Schmitt. Issued Apr. 3, 1952. 19p. (K-892)

A pilot plant investigation of a high-temperature fluorine-steam disposal system is described. By reacting fluorine with steam at elevated temperatures, an uninhibited burning reaction occurs with the liberation of considerable heat which may be removed by cooling the walls of the reactor. (auth)

3245

THE PROPERTIES AND REACTIONS OF PERFLUOROBUTYROLACTONE. Murray Hauptschein, Charles S.

Stokes and Aristid V. Grosse. *J. Am. Chem. Soc.* **74**, 1974-6(1952) Apr.

Various physical and chemical properties of perfluorobutyrolactone are described. This novel type lactone reacts with water, ethanol, ammonia, hydrogen iodide and ethyl mercaptan to form the perfluorosuccinic acid, ethyl ester, amide, mixed acyl fluoride-acyl iodide and dibasic thiol ester, respectively. The latter derivative is the first member of a new class of compounds to be reported. A general mechanism for these reactions has been elucidated. The method of formation of perfluorobutyrolactone was shown not to be general. Perfluorovalerolactone was not detected in the corresponding reaction of silver perfluoroadipate with iodine, 1,4-diiodooctafuorobutane being the only organic product isolated. Several infrared spectra are given and discussed. (auth)

GRAPHITE

3246

Atomic Energy Research Establishment, Harwell, Berks (England)

A CALCULATION OF THE CONDUCTION ELECTRONIC ENERGY LEVELS IN GRAPHITE, by D. F. Johnston. Jan. 1952. 20p. (AERE T/R-855)

A fourth-order determinantal equation for the conduction electronic energy levels in graphite is set up using the "tight-binding" approximation. It is shown how the crystal geometry determines the symmetry properties of the roots. Approximate solutions are found by neglecting certain terms. According to these solutions, the "top" of the filled bands of energy states just touch the "bottom" of the next empty band of states. This was the conclusion of Wallace (*Phys. Rev.* **71**, (1947)). The present calculation goes beyond this result by exploiting the discovery that the quartic equation factorizes for points in κ -space lying on certain sets of parallel planes. These new solutions reveal that the energy bands overlap and so provide an explanation of the metallic electrical conductivity of graphite without special assumptions about the mean free path. (auth)

3247

PARTICULAR FORMS OF THE ADSORPTION ISOTHERMS OF METHANE ON GRAPHITE AND VARIOUS OTHER SUBSTANCES. Lucien Bonnetain, Xavier Duval, and Maurice Letort. *Compt. rend.* **234**, 1363-6(1952) Mar. 24. (In French)

Breaks in adsorption and desorption isotherms of CH_4 on various artificial and natural graphites at -195°C cannot be explained by capillary condensation following completion of a molecular monolayer, but must be attributed to formation of successive adsorption layers. The adsorption isotherms of CH_4 on MoS_2 , CdCl_2 , CdI_2 , and HgBr_2 at -195°C are completely analogous to those on graphite. These compounds are similar in having a laminar structure.

RADIATION CHEMISTRY

3248

Institute of Science and Tech., Univ. of Arkansas
CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS;
ANNUAL PROGRESS REPORT. Mar. 15, 1952. 29p.
(AECU-1967)

In connection with studies of covalent bond rupture in molecules containing β -radioactive nuclides, the exchange and hydrolysis reactions of Ce and Pr acetylacetonate were studied. The bond rupture accompanying decay of Pb^{210} as the tetramethyl in dilute solution fails to show the simple concentration dependence hitherto observed in hot-atom processes, and preliminary observations indicate a dependence on mass of diluent atoms in both gaseous and liquid systems. Studies of the decay schemes of Pb^{210} and Bi^{210} in-

dicated an isomeric state of Bi^{210} appearing in Pb^{210} decay. Indications of complexity in Bi^{210} decay are discussed. Theoretical studies of ionization accompanying β decay, and of the influence of atomic binding energy on β spectral shapes are reported. Progress on the following projects is reported briefly: chemical behavior of I^{131} as trace concentrations, effect of C^{14} on rate of rupture and formation of C-C bonds, and mechanisms of organic reactions.

3249

Notre Dame Univ.

RADIOLYSIS OF HYDROCARBON MIXTURES (thesis), by J. P. Manion and Milton Burton. [nd] 45p. (AECU-1990)

Yields of hydrogen, methane, acetylene, and ethylene resultant from action of 1.5-Mv electrons on pure liquid toluene, cyclohexene, benzene and cyclohexane as well as the liquid mixtures toluene-benzene, cyclohexene-benzene, cyclohexane-benzene, and cyclohexane-cyclohexene are consistent with a mechanism in which both ionization transfer and excitation transfer play a significant role. Because of ionization transfer the primary chemical process occurring in a mixture tends to be characteristic of the component of lower ionization potential. Excitation transfer usually operates similarly. In cyclohexene-benzene radiolysis the two effects apparently act in opposition, with cyclohexene playing a sacrificial role in protection of benzene ions and benzene offering sponge-type protection to excited cyclohexene molecules. Comparison of the C_2 gaseous products from liquid and vapor radiolyses of benzene and cyclohexene indicates fundamental differences in mechanism in the two phases. In the vapor mixture of these compounds, as well as in the pure vapors, violent attack by free atoms apparently occurs. (auth)

3250

Argonne National Lab.

DECOMPOSITION OF HYDROGEN PEROXIDE, by Edwin J. Hart and Max S. Matheson. Mar. 18, 1952. 14p. (AECU-2002; UAC-539)

The termination step of the γ -ray-induced decomposition of H_2O_2 was reinvestigated using exhaustively purified H_2O_2 and a greater degree of reaction than that previously employed. Data are presented in tabular form. Third-order termination in H_2O_2 is discussed in detail.

RARE EARTHS AND RARE-EARTH COMPOUNDS

3251

THERMOMAGNETIC STUDY OF METALLIC PRASEODYMIUM. Charlotte Henry la Blanchetais. *Compt. rend.* **234**, 1353-4(1952) Mar. 24. (In French)

The magnetic susceptibility of a sample of Pr containing 0.1% Si, 0.2% Mg, 0.4% Pt, and 99.3% Pr was measured from 77 to 1070°K . The Curie point was -21°K , and the Curie constant, C_a , was 1.5765. The moment, μ , calculated by Langevin's formula, was 3.56 n.m. Considering the non-magnetic impurities present, this is probably equal to the theoretical value for the Pr^{+3} ion, 3.62. Above 500°K the $1/\chi$ plot deviates from the straight line of lower temperatures.

3252

MATRIX ELEMENTS AND OPERATOR EQUIVALENTS CONNECTED WITH THE MAGNETIC PROPERTIES OF RARE EARTH IONS. K. W. H. Stevens. *Proc. Phys. Soc. (London)* **65A**, 209-15(1952) Mar. 1.

An account is given of the methods used to determine the matrix elements of crystal field potentials with particular reference to rare earth ions. Emphasis is laid on the importance of Wigner coefficients in such problems and the idea of using equivalent angular momentum operators is developed. For convenience in applying the results tables of matrix elements are included. (auth)

SEPARATION PROCEDURES

3253

Columbia Univ.

SEPARATION OF ISOTOPES BY CHEMICAL EXCHANGE IN THERMAL DIFFUSION COLUMNS; ANNUAL PROGRESS REPORT, by William P. Senett, Russell W. Pierce, Fred Gollob and T. I. Taylor. Issued Aug. 20, 1951. 46p. (NYO-624)

Preliminary work is described in a study of the concentration of isotopes by chemical exchange in thermal diffusion columns. Experiments on thermal diffusion of the individual and mixed components of the CO-CO₂ and NO-NO₂ systems are summarized. Included is a discussion of the theory of the separation of isotopes by chemical exchange in thermal diffusion columns. A modified Barth circuit to compensate against zero-point shift due to power-supply variations is described. Progress is reported in the building and calibrating of equipment for a study of the separation of H and deuterium by chemical exchange in thermal diffusion columns. Equipment is being assembled for use in an investigation of the kinetics and catalysis of isotope exchange reactions.

3254

FUNDAMENTAL REACTIONS IN THE VACUUM-FUSION METHOD AND ITS APPLICATION TO THE DETERMINATIONS OF O₂, N₂, AND H₂ IN Mo, Th, Ti, U, V, AND Zr. H. A. Sloman, C. A. Harvey, and O. Kubaschewski. *J. Inst. Metals* 80, 391-07(1952) Mar.

In a previous publication (*J. Inst. Metals* 71, 391(1945)), the application of the vacuum-fusion method to the determination of oxygen, nitrogen, and hydrogen in certain nonferrous metals and alloys was described. The present paper deals with the application of the method to six further metals. The optimum conditions for each are discussed, and a mechanism for the reactions forming the basis of the method, derived from practical results and thermodynamical calculations, is postulated. Results showing the relation between the gas contents and the methods of preparation or subsequent treatments of the various metals are included, together with some observations on the effects of the gaseous elements on their properties. The detailed derivations of the thermodynamical data used in the paper are given in an appendix. (auth)

3255

QUANTITATIVE SEPARATION OF TRACES OF LITHIUM CONTAINED IN CALCIUM. H. Hering. *Anal. Chim. Acta* 6, 340-50(1952) Apr. (In French)

The separation of 0.5 µg of Li⁺ from a quantity of Ca⁺⁺ (up to 0.5 g) by cation-exchange resins is described. (auth)

3256

SEPARATION OF THORIUM AND LANTHANUM BY ION EXCHANGE. P. Radhakrishna. *Anal. Chim. Acta* 6, 351-4 (1952) Apr. (In French)

A simple and efficient method for the separation of Th and La by ion-exchange is described. La is eluted first of all with citric acid and then the Th is separated with H₂SO₄ as eluant. The separation is complete, and the method can be applied to all the rare-earth elements. (auth)

SPECTROSCOPY

3257

Argonne National Lab.

THE SPECTRUM OF He³ I, by Mark Fred, Frank S. Tomkins, James K. Brody, and Morton Hamermesh. [nd] 69p. (AECU-2004; UAC-297)

This material appeared in *Phys. Rev.* 82, 406-21(1951) and was abstracted in *Nuclear Science Abstracts* as NSA 5-4537.

3258

Los Alamos Scientific Lab.

THE SOLUTION ABSORPTION SPECTRA OF AMERICIUM (III), (V), AND (VI), by S. E. Stephanou, J. P. Nigon and R. A. Penneman. [nd] Decl. Apr. 23, 1952. 21p. (AEC-3362; LADC-1147)

This investigation was undertaken to obtain better data on the absorption spectra of Am(V) and (VI), using an instrument of higher resolving power than the Beckman; to determine accurately the molecular extinction coefficients of the Am absorption-band maxima; and to search for vibrational fine structure in Am(V) and (VI) similar to that reported for U(VI), Np(V), Np(VI), and Pu(VI). This fine structure has been interpreted as arising from symmetrical metal-oxygen vibration in ions of the type MO₂⁺ and MO₂⁺⁺.

3259

Los Alamos Scientific Lab.

INFRARED SPECTRA AND STRUCTURE OF URANYL AND TRANSURANIUM (V) AND (VI) IONS IN AQUEOUS PERCHLORIC ACID SOLUTION, by Llewellyn H. Jones and Robert A. Penneman. [nd] Decl. Apr. 23, 1952. 6p. (AEC-3363; LADC-1144)

Infrared spectra of aqueous solutions of U(VI), Np(VI), Pu(VI), Am(VI), Np(V), and Am(V) ions show conclusively that these ions exist as symmetrical XO₂⁺⁺ and XO₂⁺, the former being linear or very nearly linear. (auth)

SYNTHESES

3260

Radiation Lab., Univ. of Calif.

PHOTOSYNTHESIS, by M. Calvin, J. A. Bassham, A. A. Benson, and P. Massini. Mar. 1952. 26p. (UCRL-1720)

A review is presented of recent experimental work on the process of photosynthesis. The work of Warburg and his coworkers on their proposal for the existence of a light-induced O₂ absorption and corresponding CO₂ evolution which can amount to three or four times the net O₂ evolution by the same light, and the discovery of the early participation of 7- and 5-carbon sugars in CO₂ reduction in photosynthesis together with some observations on the kinetics of metabolic transformations are discussed in detail. *60 references

TRANSURANIC ELEMENTS AND COMPOUNDS

3261

Radiation Lab., Univ. of Calif.

DISPROPORTIONATION EQUILIBRIA AND RATES IN PERCHLORIC AND HYDROCHLORIC ACID; SOLUTIONS OF PLUTONIUM: INFLUENCE OF ALPHA PARTICLES, by Robert E. Connick and William H. McVey. Mar. 1952. 29p. (UCRL-1687)

The data of Kasha and Sheline on rates and equilibria of the disproportionation reaction of plutonium (IV) to give plutonium (III) and plutonium (VI) have been corrected for the reduction caused by the plutonium alpha particles. It was necessary to assume reaction paths for the alpha particle induced reduction and one electron reductions of Pu(VI) and Pu(IV) were chosen as most plausible. The disproportionation mechanism was found to be consistent with that previously deduced from the disproportionation of plutonium (V). The equilibrium for the disproportionation of plutonium (IV) exhibited approximately the expected fourth power dependence on hydrogen ion concentration in perchloric acid at unit ionic strength and 25°C. An apparent fifth power dependence was obtained for hydrochloric acid solutions, not at constant ionic strength. The disproportionation rate showed an inverse third power acid dependence in perchloric acid at constant ionic strength and an apparent -3.5 power dependence in hy-

drochloric acid solutions, without added salt. Approximate values of 40 kcal and +60 e.u. were calculated for heat and entropy of activation of the disproportionation reaction in one molar hydrochloric acid. The formal potentials of the Pu(III)-Pu(VI) and Pu(IV)-Pu(VI) couples in one molar perchloric acid at 25° are -1.043 ± 0.003 and -1.022 ± 0.002 volts, respectively. The corresponding values for one molar hydrochloric acid are -1.053 ± 0.003 and -1.025 ± 0.002 volts. The discrepancy concerning chloride complexing of PuO_2^{++} is nearly eliminated by the new values for the disproportionation equilibrium quotient. It is pointed out that the assumption of a small amount of complexing of Pu^{+3} by chloride ion would give complete agreement and evidence is advanced in support of this hypothesis. (auth)

3262

Radiation Lab., Univ. of Calif.

THE TRANSURANIUM ELEMENTS; PRESENT STATUS; NOBEL LECTURE, by Glenn T. Seaborg. Dec. 12, 1951. 38p. (UCRL-1724)

The discovery of the transuranium elements and the work done on them up to the present time are reviewed. The properties of these elements, their relationship to other elements, their place in the periodic table, and the possibility of production and identification of other transuranium elements are discussed briefly.

3263

CHEMISTRY AND ACTINIDE THEORY OF THE TRANSURANIC ELEMENTS. Reinhard Nast and Tibor von Krakay. *Fortschr. chem. Forsch.* 2, 484-537(1952). (In German)

An extensive review is presented of the chemical and physical properties of elements 93 to 98 and of the properties of elements 90 to 92 having significance with respect to the actinide theory. 140 references

URANIUM AND URANIUM COMPOUNDS

3264

LUMINESCENCE SPECTRA AND EXTINCTION OF URANYL COMPOUNDS. A. N. Sevchenko. *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* 15, 613-23(1951) Sept.-Oct. (In Russian)

Effects of temperature on the luminescence spectra and extinction time of hydrated crystals and solutions of uranyl sulfate, nitrate, chloride, bromide, acetate, and phosphate are discussed. The variation of extinction time of uranyl nitrate with the number of associated H_2O or D_2O molecules is tabulated, and effects of solvent are shown graphically.

ENGINEERING

3265

Knolls Atomic Power Lab.

SINGLE AND DOUBLE-REHEAT CYCLES FOR STEAM POWER PLANTS, by R. H. Shannon and J. D. Selby. Apr. 4, 1952. 11p. (AECU-1976)

The practical possibility of using double reheat cycles for increasing the thermal efficiency of steam power plants is discussed. A comparison is made of plant thermal efficiencies for a non-reheat cycle and single and double reheat cycles. Data are presented in tabular form. A method of superheating steam by carrying the heat from the boiler to a resuperheater located near the turbine by means of a liquid metal (Na) heat-transfer system is proposed. Tables give data on station heat rates between comparable systems, and comparison of the normal method of superheating steam in the boiler with other systems.

AEROSOLS

3266

Harvard Univ., School of Public Health

HANDBOOK ON AIR CLEANING (PARTICULATE REMOVAL), by Sheldon K. Friedlander, Leslie Silverman, Philip Drinker and Melvin W. First. [nd] Decl. Apr. 18, 1952. 114p. (AECU-3361; NYO-1572)

This handbook is a collection of current information on methods of removing particulate matter from gases and criteria for judging their effectiveness. It is divided into four chapters dealing with behavior of aerosols in air cleaning, air-cleaning equipment, performance and evaluation of air-cleaning equipment, and special problems involved in the cleaning of radioactive aerosols. 75 references.

HEAT TRANSFER AND FLUID FLOW

3267

Argonne National Lab.

THE EFFECT OF FILM BOILING, by J. C. Carter. Feb. 7, 1952. 25p. (ANL-4766)

Evidence is presented that a boiling film has the characteristics of a boundary layer phenomenon by showing how the principal variables affect polytropic forced flow. A technique employing high-speed photography is suggested for taking data from which generalized equations may be evolved to define the state and energy transformation at any condition.

3268

National Advisory Committee for Aeronautics

MEASUREMENTS OF AVERAGE HEAT-TRANSFER AND FRICTION COEFFICIENTS FOR SUBSONIC FLOW OF AIR IN SMOOTH TUBES AT HIGH SURFACE AND FLUID TEMPERATURES, by Leroy V. Humble, Warren H. Lowdermilk, and Leland G. Desmon. 1951. 15p. (NACA-1020)

An investigation of forced-convection heat transfer and associated pressure drops was conducted with air flowing through smooth tubes for an over-all range of surface temperature from 535 to 3050°R, inlet-air temperature from 535 to 1500°R, Reynolds number up to 500,000, exit Mach number up to 1, heat flux up to 150,000 Btu per hour per square foot, length-diameter ratio from 30 to 120, and three entrance configurations. Most of the data are for heat addition to the air; a few results are included for cooling of the air. The over-all range of surface-to-air temperature ratio was from 0.46 to 3.5. (auth)

3269

THERMAL STRESSES AND DEFORMATIONS IN ELASTIC BODIES WITH PLANE STATIONARY HEAT FLOW. Fritz Salzmann. *Z. angew. Math. u. Phys.* 3, 129-48(1952) Mar. 15. (In German)

The paper deals with the thermal stresses and deformation in an elastic body with a steady, two-dimensional heat flow. General relations between temperature distribution and deformation, using functions of the complex variable $x + iy$, are established. The analysis leads to a particular solution, for which in sections perpendicular to the plane of flow (x, y) stresses do not occur for a steady heat flow without sources or sinks, in a simply connected region. Different examples of temperature distribution with corresponding deformation are presented. Finally, the thermal stresses occurring in a hollow cylindrical body with arbitrary cross section are treated in a general way and special reference is made to stresses in circular tubes. (auth)

3270

ELEMENTARY SOLUTIONS OF THE EQUATIONS GOVERNING THE FLOW OF COMPRESSIBLE FLUIDS. Paul Germain. *Compt. rend.* 234, 1248-50(1952) Mar. 17. (In French)

A simple method for constructing the elementary solutions of certain fluid-flow equations is indicated. Use is made of an extension of the Fourier transform due to Schwartz (Théorie des distributions, Paris, Hermann, 1951). Some results obtained previously for the case of the simple Tricomi equation are generalized.

3271

HEAT-TRANSFER AND HEAT-FLOW METERS. Gerhard Eichert. Arch. tech. Messen 194, 57-60(1952) Mar. (In German)

A simple instrument to measure heat flow or determine lines of equal thermal flux in high-temperature applications is described. It consists of a small loop of pipe through which flows water, oil, mercury, etc. Measurement of the difference between inlet and outlet temperature gives the heat flow in absolute units.

3272

HEAT EMISSION BY WIRES IN STILL AIR. CONTRIBUTION TO NUMERICAL CALCULATIONS. J. Fischer. Z. angew. Physik 4, 90-4(1952) Mar. (In German)

Calculated Nusselt's functions for heat emission by horizontal wires, rods, or tubes in stationary air are plotted for various diameters and temperature elevations. 7 figures.

3273

TEMPERATURE REGIME OF HORIZONTAL HIGH-PRESSURE STEAM BOILER TUBES. M. A. Styrikovich and Z. L. Miropol'skiĭ. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, 1495-1512(1951) Oct. (In Russian)

3274

EXPERIMENTAL DETERMINATION OF LOCALIZED AND AVERAGE COEFFICIENTS OF HEAT TRANSFER DURING TURBULENT FLOW OF LIQUIDS IN TUBES. I. T. Alad'ev. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, 1669-81 (1951) Nov. (In Russian)

3275

ON THE ASSOCIATION OF A GENERALIZED INTEGRAL EQUATION WITH THE HYDRODYNAMIC THEORY OF HEAT EXCHANGE AND ON ITS APPLICATION TO CALCULATION OF HEAT EXCHANGE IN BOUNDARY-CONDITION PROBLEMS [IN FLUID FLOW]. B. V. Stark, E. V. Chelishchev, and E. A. Kazachkov. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, 1682-8(1951) Nov. (In Russian)

PUMPS

3276

Knolls Atomic Power Lab.

HOMOPOLAR GENERATOR PUMP FOR LIQUID METALS, by Leonard B. Vandenberg. Aug. 13, 1951. Decl. Apr. 18, 1952. 83p. (AECD-3368; KAPL-590)

This report presents the results of combining a homopolar generator and a simple d-c electromagnetic liquid metal pump in one unit. An experimental pump proved the feasibility of such a combination, and it also proved that compact pumps of high efficiency can be built. The problems usually presented by bearings, seals, heavy bus-bar connections, lead losses, and bulky power-conversion equipment, which are associated with the pumping of liquid metal, are largely eliminated. (auth)

RADIOGRAPHY

3277

Los Alamos Scientific Lab.

REPORT ON THE INVESTIGATION OF BETATRON

RADIOGRAPHIC TECHNIQUES, by Clark J. Smith. Apr. 30, 1951. Decl. Apr. 28, 1952. 30p. (AECD-3357; LADC-992)

An investigation was made of factors affecting betatron radiography. Included are a preliminary report on the pro-

tection of film from scattered radiation during the exposure of a betatron radiograph, results of an investigation of comparative effect of Pb front and back screens on density of film exposed to a 22-Mev betatron beam, comparison of some materials when used as an intensifying screen for film exposed to a 22-Mev betatron beam, a preliminary report on the use of a beam-intensity-equalizing Pb cone for use in betatron radiography, and a preliminary report on the effect of the vertical alignment of the betatron x-ray tube on pinhole image obtained.

VACUUM SYSTEMS

3278

MEASUREMENT OF VERY SMALL PRESSURES UNDER 10^{-7} mm Hg BY MEANS OF AN ADSORPTION MANOMETER. M. Seddig and G. Haase. Z. angew. Physik 4, 105-8(1952) Mar. (In German)

The time dependence of the work of electron emission, as measured by the photoelectric method of Fowler (Phys. Rev. 38, 45(1931)), of a tungsten surface purified by glowing may be used to estimate pressure changes below 10^{-7} mm Hg.

3279

TECHNIQUES AND EQUIPMENT FOR MEASUREMENT OF VERY SMALL GAS PRESSURES. III. FRICTION MANOMETERS AND VACUUM GAGES ON THE RADIOMETER PRINCIPLE. Helmut Schwarz. Arch. tech. Messen 194, 53-6(1952) Mar. (In German)

A review of various types of vacuum gages, including brief descriptions of design and applications, is concluded. 173 references

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

3280

Argonne National Lab.

PREPARATION OF REFRACTORIES FROM URANIUM DIOXIDE, by R. E. Corwin and G. B. Eyerly. Apr. 29, 1952. Decl. Apr. 22, 1952. 14p. (AECD-3349; ANL-HDY-703)

Both pressing and slip casting can be used for forming UO_2 refractories. UO_2 should not be left in contact with dies or metal containers any longer than necessary, to avoid corrosion. After the shapes have dried for several days at room temperature, they are fired in a H_2 atmosphere in a Mo resistance furnace to a maximum temperature of 1750°C. The furnace must be cooled to 50°C before the refractories are removed, to prevent oxidation. Variation in density of the finished refractory with firing treatment is shown graphically. Shrinkage averages around 14 to 15%. Precautions must be taken against getting UO_2 into the body.

CORROSION

3281

MECHANISM OF CORROSION BY OXYGEN. René Audubert. Compt. rend. 234, 1448-50(1952) Mar. 31. (In French)

Expressions are derived from the theory of over-voltage for the corrosion kinetics of a metal in contact with an electrolyte and O_2 .

GEOLOGY AND MINERALOGY

3282

RADIOACTIVITY SURVEYS AID PROSPECTING FOR OIL AND GAS. Hans Lundberg. Precambrian 25, No. 4, 9, 21(1952) Apr.

Air-borne studies have been conducted with a scintillation counter in prospecting for oil and gas. Continuous γ -ray recordings were obtained along parallel flight lines at altitudes of 150 to 500 ft and at speeds as high as 150 to 180 mph. A theory is suggested that upward movement of subterranean water carries dissolved radioactive salts, and contact between the water and oil or gas pools causes the water to move to the side, thereby causing greater concentrations of radioactive salts at the boundary of the oil or gas pools.

3283

ON A NEW METHOD OF CHEMICAL AGE DETERMINATION BY THE LEAD METHOD. F. G. Houtermans. Sitzber. heidelberg. Akad. Wiss. Math.-naturw. Klasse, 123-36(1951). (In German)

The classical RaD/Pb-ratio method can be carried out by measuring the specific activity of the Pb with counters, nuclear emulsions, or ionization chambers. The equilibrium amount of RaD (Pb^{210}) is determined by the activity of RaE (Bi^{210}) and RaF (Po^{210}). The Th content can be found from the ThB (Pb^{212}) activity. The advantage of the method is its applicability to the smallest amounts of radioactive minerals.

3284

THE ORGANIZATION OF THE SEARCH FOR URANIUM IN FRANCE. Felice Ippolito. *Ricerca sci.* 22, 13-16(1952) Jan. (In Italian)

The organization and work of the Direction recherches géologiques et exploitations minières of the Commissariat à l'énergie atomique in discovering and developing uranium deposits in France is discussed briefly.

3285

STUDY OF RARE EARTH MINERALS BY NEUTRON ABSORPTION. I. H. Ford and E. E. Picciotto. *Nouvo cemento* (9) 9, 141-4(1952) Feb. 1. (In French)

The possibility of localizing rare-earth minerals in thin lamina of rocks and determining the concentration in terms of Sm + Gd by absorption of thermal neutrons is discussed. Nuclear plates loaded with boron were used to measure the absorption of 1-mm-thick samples of monazite and bast-nasite in order to illustrate the method.

METALS AND METALLURGY

3286

Massachusetts Inst. of Tech.

TRANSFORMATION MECHANISM OF ZIRCONIUM (thesis), by Edgar Eben Hayes. Sept. 1951. 82p. (AECU-1960)

The allotropic transformation of zirconium (from a body-centered-cubic phase to a hexagonal-close-packed phase) has been investigated in order to obtain additional information concerning the characteristics of the mechanism. The investigation included (1) high speed thermal analysis, (2) attempts to retain beta zirconium at room temperature, (3) high speed resistivity measurements, (4) attempts to determine habit relationships, and (5) microstructures resulting from cooling single crystals of beta zirconium in a preferred direction. The observable characteristics of the transformation of pure zirconium have been found to differ in two respects from impure zirconium. First the acicular character of the zirconium microstructures obtained by quenching from above the transformation temperature is absent when the zirconium is sufficiently pure. Second the impure zirconium exhibits sharp discontinuities in r resistivity curves taken during rapid cooling through the transformation range. This indicates a "burst" effect during the transformation which is absent in the pure zirconium. Although there is no sharp demarkation point in observing these effects as a function of impurity content, a value of about 0.1 weight percent oxygen appears to be

necessary to obtain the acicular microstructures and burst effect in the resistivity curves. (auth)

3287

Knolls Atomic Power Lab.

VANADIUM, by Alan U. Seybolt. [nd] 10p. (AECU-1993)

The metallurgy of V is briefly reviewed. Its physical, chemical, and mechanical properties are noted. Although the reduction methods are not described, the advantages and disadvantages of each method are given. The processing methods and alloying procedure for V are also briefly mentioned.

3288

Notre Dame Univ.

THE TITANIUM-IRON PHASE DIAGRAM, by W. J. Fretague, C. S. Barker, and E. A. Peretti. Nov. 1951. 42p. (AF-TR-6597(pt.1))

This project was concerned with the development of a phase diagram of the titanium-iron system, with special emphasis on that region of the diagram between 0 and 50 percent iron and from room temperature up to and including the solidus of the system. An arc melting furnace, employing a water-cooled tungsten electrode and copper crucible, was constructed and operated with an argon atmosphere. Approximately seventy-seven arc-melted alloys were prepared covering the composition range from 0 to 71 percent iron. Hardness data on the as-cast alloys were collected and metallographic examination of all as-cast alloys performed. A tentative diagram was constructed from the information obtained from metallographic examination of the arc-melted alloys, and from published information appearing in the literature. The eutectic composition of the system was estimated to be at approximately 32 percent iron as determined by examination of the as-cast structures. The eutectic temperature of the Process A titanium - 32 percent iron alloy was determined to be $1094 \pm 1^\circ\text{C}$. Thermal analysis of a 10 percent iron alloy established an arrest at approximately 550°C . At the present time, this is believed to be a eutectoid reaction although typical eutectoid microstructures have not been obtained. (auth)

3289

Battelle Memorial Inst.

SUMMARY REPORT COVERING THE PERIOD JULY 1, 1950 TO MAY 18, 1951 ON DEVELOPMENT OF TITANIUM-BASE ALLOYS. June 18, 1951. 166p. (AF-TR-6623)

This report describes the preparation and evaluation of various binary, ternary, quaternary, and more complex titanium alloys, and the evaluation of certain of the engineering properties of the titanium-base alloy with 3 per cent chromium-1.5 per cent iron-0.1 per cent nitrogen. The arc-melting furnace which was used to melt 20-pound, 4-inch-diameter ingots has been modified. The three electrodes have been replaced by a single electrode having a thoriated-tungsten electrode tip which permits using the long-arc melting technique. Minor changes have also been made in the design of the copper crucible. The redesigning of the large furnace and the use of the long-arc melting technique have made possible a reduction in tungsten contamination from the electrode in the arc-melting process. Minor changes in the method of making alloy additions are also reported. The fabricating procedure has been varied in order to permit greater forging reductions in the ingots and the utilization of cross rolling in the hot-rolling operation. (auth)

3290

Ames Lab.

ELECTRICAL PROPERTIES OF THIN METALLIC FILMS, by D. B. Barker and W. C. Caldwell. Mar. 20, 1952. 14p. (ISC-215)

The Hall coefficient and conductivity of silver films were measured by a d-c method and comparisons with the theo-

retical calculations of Fuchs and Sondheimer were made. Films from 150 Å to 1500 Å in thickness were deposited by evaporation at pressures below 10^{-2} microns. The electrical properties were studied at liquid nitrogen, dry ice and acetone, and room temperatures. Film-thickness measurements were made by the interferometer method. Electron diffraction and electron micrograph pictures were taken to study aggregation and to check on the purity of the films. The electron micrographs show aggregation in films less than 300 Å thick. The electrical measurements also indicate this change in the thinnest films. A variation of Hall coefficient and conductivity with thickness was found but only qualitative agreement between theory and experiment was indicated. (auth)

3291

Armour Research Foundation
SURFACE HARDENING OF TITANIUM WITH METALLOID ELEMENTS; INTERIM TECHNICAL REPORT NO. 1; JUNE 1–NOVEMBER 30, 1951, by Fred Kisslinger and Gary Steven. [nd] 22p. (NP-3716; U21537)

Studies were initiated concerning the surface hardening of commercially pure Ti and its alloys by the addition of O, N, C, B, and H. Heating Ti in an N atmosphere at temperatures above 1500° produced a thin hard surface layer with Vickers hardness values ranging from 600 to 1000. The brittleness resulting from heating Ti in air and from pack-carburizing Ti between 1000 and 2000°F appeared to be caused by the rapid diffusion of the absorbed O. The brittleness of pack-carburized Ti increased with higher temperatures and longer heating times. The slower O pickup of α Ti compared to β Ti was verified. Initial data on a Ti-V alloy containing 5 at. % V indicated greater hardening of the alloy at lower temperatures; hardening of commercially pure Ti was negligible at these temperatures. (NRS abst.)

3292

EFFECTS OF WORKING ON THE PROPERTIES OF MOLYBDENUM. E. S. Byron and R. F. Baker. *J. Electrochem. Soc.* 99, 194-6(1952) May

Heat-treated unworked molybdenum made by the powder metallurgy process has an ultimate strength of about 60,000 to 70,000 psi and an elongation of usually less than 1%. Upon rolling at suitable temperatures, however, the hardness increases and, under some conditions, the strength and ductility are greatly improved in the direction of the metal flow brought about by the working. There is no improvement in strength or ductility in the compressive direction, that is, the direction in which flow does not take place. (auth)

TRACER APPLICATIONS

3293

Massachusetts Inst. of Tech.

THE ADAPTATION OF TRACER TECHNIQUES TO MINERAL ENGINEERING PROBLEMS; PROGRESS REPORT, by H. Rush Spedden. Oct. 15, 1949. 16p. (MITS-4)

Experiments on rate of oxidation of radioactive pyrite are described; data on the reaction of Ag^+ and Cu^{++} at the surface of sphalerite in activation flotation tests, on surface area measurements, and removal of silver coatings are given. After irradiation of granite and diabase with thermal neutrons, Na^{24} is the main artificially created radioactive constituent. Anthragallol (1,2,3-trihydroxyanthraquinone-9,10- C^{14} -9) was synthesized from C^{14}O_2 and phenyl Mg bromide. A surface measurement technique is described in which krypton adsorbed on the surface gives a measure of its area. Half lives and activities to be expected from neutron activation of various isotopes in ores in a picker-belt application are tabulated.

3294

Massachusetts Inst. of Tech.

THE ADAPTATION OF TRACER TECHNIQUES TO MINERAL ENGINEERING PROBLEMS; by A. M. Gaudin, Director. July 17, 1950. 23p. (NYO-587; MITS-8)

Reaction mechanisms and rate of take-up by sphalerite of Ag from aqueous AgNO_3 solutions are studied. Results of tests on adsorption of mercaptan on sphalerite are given; the flotation cell constructed for these tests is illustrated. Results of tests showing the amount of adsorption of dodecylamine acetate on hematite are tabulated. Experimental techniques for depression of pyrite in flotation are described; about 0.05 mg of Ca per gram of pyrite were absorbed from a solution containing 0.039 g of Ca per liter. Equipment for measuring surface tensions by the pendant drop method is described. Methods for measurement of self-diffusion of Na into albite and related minerals are investigated.

PHYSICS

3295

General Engineering Lab., General Electric Co.

UTILIZATION OF THE GROSS FISSION PRODUCTS; PROGRESS REPORT NO. 1 FOR THE PERIOD JUNE 1, 1951 TO DECEMBER 31, 1951 (Unclassified Section), by R. A. Dewes and E. E. Goodale. Issued Jan. 10, 1952. 23p. (SO-1100)

The performance of radiation sources of various configurations are being studied. Calculations were made for a hollow cylinder source geometry to determine the dosage rate at points inside the cylinder, and to determine optimum dimensions for the cylinder. Data are plotted.

3296

Yale Univ.

STUDIES IN THE THEORY OF THE POLAROGRAPHIC DIFFUSION CURRENT; VI. THE EFFECT OF IONIC STRENGTH ON THE DIFFUSION CURRENT CONSTANT IN THE ABSENCE OF GELATIN, by Louis Meites. Nov. 3, 1950. 12p. (NYO-803)

Data on the diffusion current constant of thallium (I) in 0.01–4.1F hydrochloric acid solutions are presented. At acid concentrations below 0.1F, these data are in agreement with the Onsager limiting law for the diffusion coefficient of an ion whose transference number is zero. Extrapolation to infinite dilution indicates that the diffusion current dependence expressed by the Ilkovič equation is in error by about 20%. (auth)

3297

Laboratory for Insulation Research, Mass. Inst. of Tech.
TECHNIQUES OF MEASURING THE PERMITTIVITY AND PERMEABILITY OF LIQUIDS AND SOLIDS IN THE FREQUENCY RANGE 3 C/S TO 50 KMC/S, by W. B. Westphal. July 1950. 183p. (NP-3707; U12339)

3298

Pittsburgh Univ.

THERMODYNAMICS OF CRYSTALLINE SOLUTIONS; PROGRESS REPORT FOR JANUARY 1, 1952 TO APRIL 1, 1952, by W. E. Wallace, R. S. Craig, W. T. Barrett, L. W. Coffey, R. A. Flinn, W. H. McCoy, and J. S. Wollam. Apr. 7, 1952. 5p. (NYO-947)

A brief résumé is given of the status of the several problems underway. No appreciable experimental data are included.

3299

Research Foundation Ohio State Univ.

PROBLEMS CONCERNED WITH PHYSICAL PHENOMENA AT VERY LOW TEMPERATURE, ESPECIALLY THOSE RELATED TO NUCLEAR PARAMAGNETISM; STATUS REPORT (FOR THE PERIOD JULY 1, 1950 THROUGH MARCH 15, 1951), by J. G. Daunt. Mar. 15, 1951. 89p. (AECU-1955; Report No. 1)

This report covers the first nine months of progress under the contract program. The low-temperature facilities developed are described in detail and illustrated by diagrams and photographs. Brief report is made of the status of experiments in the following fields of study: the magnetic properties of superconductors below 1°K; the magnetic and thermal properties of superconductors below 1°K; direct calorimetric investigations; investigations of the conditions necessary for the establishment and measurement of nuclear spin systems at temperatures <0.01°K; investigations on the He film; and investigations of mixtures of He³ and He⁴.

3300

Los Alamos Scientific Lab.

BOUNDARY DISTURBANCES IN HIGH EXPLOSIVE SHOCK TUBES, by R. G. Shreffler. Mar. 31, 1952. Decl. May 1, 1952. 19p. (AECU-3355; LADC-1154)

High velocity disturbances are observed to propagate in advance of the plane shock front along the walls of a high-explosive-operated shock tube. Experiments were performed which indicate that the disturbance proceeds at a constant velocity relative to the shock front, and carries a considerable amount of energy as evidenced by its ability to penetrate metal plates. The velocity of a similar disturbance observed along a rod placed on the axis of the shock tube normal to the plane shock front was essentially independent of the rod material and diameter. This phenomenon was observed when shock tubes were filled with argon or chlorine but was absent when air or helium was used. (auth)

3301

Los Alamos Scientific Lab.

FAST JETS FROM COLLAPSING CYLINDERS, by F. J. Willig, F. A. Lucy and R. G. Shreffler. Jan. 18, 1952. Decl. Apr. 24, 1952. 36p. (AECU-3364; LADC-1157)

A method is described for producing fast jets from the collapse of metal-lined cavities in high explosives. The behavior of these jets suggests that they cannot be accounted for by the simple hydrodynamical considerations that have in the past been successful when applied to slower type jets. Various experiments, including time-resolved spectrographic observations, show the jets to be, at least in part, of a gaseous nature. Velocities as high as 90 km/sec have been observed for beryllium jets, with heavier elements exhibiting lower velocities in inverse order of their atomic weights. (auth)

3302

Cryogenic Lab., Ohio State Univ.

THERMODYNAMIC PROPERTIES OF NEUTRAL OH FROM NEAR ZERO TO 6000°K, by H. L. Johnston, Jack Belzer and Lydia Savedoff. [nd] 12p. (NP-3728; Technical Report No. 5)

The spectroscopic analysis of neutral OH has been re-examined, and the constants of the final states of the (4,1), (4,2), (4,3), and (4,4) bands and the band origins were estimated from the data of Tanaka and Koana. The rotational constants for the ground state and the vibrational constants for the upper and lower states were reevaluated to include these newer data. The thermodynamic properties of the OH molecule were computed from 1° to 6000°K and were found to agree with those previously reported by Johnston and Dawson (J. Am. Chem. Soc. 55, 2744(1933)) when account is taken of the newer values employed by the basic physical constants. (auth)

3303

BEHAVIOR OF THE HEAT CAPACITY OF SUPERCONDUCTING NIOBIUM BELOW 4.5°K. A. Brown, M. W. Zemansky, and H. A. Boorse. Phys. Rev. 86, 134-5(1952) Apr. 1.

The heat capacity of a cylindrical sample of Nb has been measured from 2.5 to 20°K in both the normal and superconducting phases. C_v/T vs. T^2 plots are presented and discussed. Below 4.5°K the data for the superconducting phase lie well below the best-fit line $C_s = 464(T/161^\circ)^3$, indicating that for Nb the superconducting specific heat below 4.5°K falls off more rapidly than a T^3 law would allow. The specific heat in the normal phase follows the usual relation $C_n = \gamma T + 464(T/\theta_n)^3$, where in this case the constants θ_n and γ are 254° and 21.0×10^{-4} cal/mole-deg². The specific heat expressed in this way fits the data from the lowest measured temperature to about 12°K, above which the experimental points fall below those predicted by the equation. The heat-capacity data reported correspond to the behavior of a sample of Nb which undergoes reversible transitions and which follows the parabolic relation with the constants $H_0 = 1960$ gauss, $T_0 = 8.7^\circ\text{K}$.

AEROSOLS

3304

Central Aerosol Labs., Columbia Univ.

PROGRESS REPORT NO. 4 COVERING PERIOD FROM SEPTEMBER 1 TO NOVEMBER 31, 1950; MEASUREMENT OF POLYDISPERSITY IN AEROSOLS. STATUS OF DIFFERENTIAL SETTLING APPARATUS, by Victor K. La Mer and Mary Louise Young. Nov. 31, 1950. 9p. (NP-3771)

3305

Central Aerosol Labs., Columbia Univ.

PROGRESS REPORT NO. 5 COVERING PERIOD FROM DECEMBER 1, 1950 TO FEBRUARY 28, 1951. PART A. A FORWARD ANGLE SCATTERING CAMERA FOR THE DETERMINATION OF PARTICULATE CONCENTRATION OF AEROSOLS, by Victor K. La Mer and P. K. Lee. PART B. INVESTIGATION OF PARTICLE SIZE BY DIFFERENTIAL SETTLINGS, by Joseph Benedict and Guy G. Goyer. [nd] 39p. (NP-3772)

3306

Central Aerosol Labs., Columbia Univ.

PROGRESS REPORT NO. 3 COVERING PERIOD FROM JUNE 1 TO AUGUST 31, 1950; STUDIES ON POLYDISPERSITY AND NUCLEATION, by Victor K. La Mer. Aug. 1950. 29p. (NP-3773)

3307

Naval Radiological Defense Lab.

AN AUTORADIOGRAPHIC METHOD OF DETECTING AND IDENTIFYING BETA-ACTIVE PARTICLES IN A HETEROGENEOUS MIXTURE, by Philip D. LaRiviere and Stephen K. Ichiki. Mar. 27, 1952. 18p. (USNRDL-342)

An autoradiographic-optical method of determining the sample statistics of the beta-gamma emitting members of a mixed radioactive and inert aerosol is presented. The aerosol components may be heterogeneous with respect to size, shape and composition. The aerosol sample is deposited on microscope cover slips and covered with autoradiographic stripping film in gelatin, forming a permanent, sealed assembly. The exposed and processed assembly is placed under the microscope in such a manner that the particles are above the emulsion. The autoradiographs under the radioactive particles are then found with conventional substage illumination and the active particles producing the autoradiographs revealed by vertical illumination. The method permits positive identification of radioactive particles down to the limit of detection of the optical system employed. Concentrations of three hundred active particles per square

millimeter of collection slide were easily resolvable in the first application of the method. (auth)

ASTROPHYSICS

3308

REMARKS ON THE NOVA PHENOMENON. IV. E. Schatzman. *Ann. astrophys.* **14**, 294-304(1951). (In French)

The following abstract appeared in *Science Abstracts* **A55**, abst. 1407, and is reproduced here.

From a study of various nuclear reactions it is concluded that He^3 could exist in small quantities in a pre-nova, and that the reaction $\text{He}^3 + \text{He}^3 \rightarrow \text{He}^4 + \text{H}^1 + \text{H}^1$ could produce a detonation wave suitable for the author's theory of nova eruptions (cf. NSA 5-6249).

3309

REMARKS ON THE NOVA PHENOMENON. V. E. Schatzman. *Ann. astrophys.* **14**, 305-12(1951). (In French)

The following abstract appeared in *Science Abstracts* **A55**, abst. 1408, and is reproduced here.

He^3 is continuously formed from H by nuclear reactions, and considerations of vibrational stability suggest that an explosion would occur when the H^3 concentration becomes sufficiently large; the same process would lead to recurrent explosions. Approximate calculations suggest that the time between successive eruptions is $\sim E/L$, where E is the energy liberated in an eruption and L is the brightness between eruptions; this result is applied to SS Cygni stars and to novae.

3310

QUASI-HOMOLOGOUS STELLAR STRUCTURES. E. Schatzman. *Ann. astrophys.* **14**, 278-93(1951). (In French)

The following abstract appeared in *Science Abstracts* **A55**, abst. 741, and is reproduced here.

By an entirely mathematical treatment it is shown that (i) Certain giant stars form a homologous sequence, the stellar nucleus showing variable composition through the series. The energy loss is due to proton-proton reactions. (ii) The dwarf and subdwarf stars may be divided into two subgroups, according as the energy loss is due either to H or to C chain-reactions. The intersection of the two sequences is explained by difference in chemical composition.

COSMIC RADIATION

3311

THE POSSIBLE EFFECTS OF κ -MESONS IN THE COSMIC RADIATION. S. Hayakawa. *Proc. Phys. Soc. (London)* **65A**, 215-19(1952) Mar. 1.

The decay and nuclear interaction schemes of κ -mesons are discussed. A tentative interpretation is made of some anomalous interactions of penetrating particles observed recently below ground. Further possible experiments testing the hypotheses made are suggested. (auth)

3312

ON THE EXISTENCE OF ROSSI SECOND AND THIRD MAXIMA OF COSMIC-RAYS. P. K. Sen Chaudhury. *Indian J. Phys.* **34**, 539-54(1951) Nov.

The controversial existence of Rossi second and third maxima of cosmic-rays were investigated in lead with a triple coincidence arrangements of counters under different geometrical conditions and definite evidences have been obtained about the existence of a second maximum at about 18 cm of lead and a third maximum at about 23 cm of lead. Except for a drop of coincidence frequency at about 20 cm, both these maxima might be considered as a single flat maximum from 16 cm to 24 cm, similar to the results reported by Schopper and others. For the interpretation of the origin of these higher maxima, from their correspondence with anomalies in RaC gamma-rays absorption in lead reported by the author, it seems that either there are

some residual photons in RaC gamma-rays and in cosmic-rays which do not obey the current theories of photon interaction and behave like an unstable neutrino or that some such radiations are produced by photon in lead. Further, from the fact that RaC gamma-rays are of maximum energy of only 2.4 Mev the author suggested that the new type of penetrating radiation may simply be a positron-electron dipole behaving as a neutral electro-meson before annihilation or being dissociated back to a positron and electron by Philips-Oppenheimer process. From energy consideration and the position of third maximum, it follows that such a dipole may have a maximum life of the order of 10^{-9} sec only. (auth)

3313

SHAPE OF COSMIC-RAY STAR-SIZE DISTRIBUTIONS IN NUCLEAR EMULSIONS. M. Birnbaum, M. M. Shapiro, B. Stiller, and F. W. O'Dell. *Phys. Rev.* **86**, 86-9(1952) Apr. 1.

The occurrence of a break in integral star-size distributions at a prong number of approximately 7, previously observed with nuclear emulsions in the lower atmosphere, has also been found at several stratosphere altitudes under a variety of conditions. This shows that the effect is due mainly to the composition of the nuclear emulsion. Although the shape of the distribution curves is thus strongly influenced by the properties of the detector, the altitude dependence of the nucleonic energy spectrum is clearly reflected in the progressive change in the slopes of these curves. (auth)

3314

ANGULAR DISTRIBUTION OF ENERGY OF SECONDARY RADIATION CREATED BY PRIMARY COSMIC RAY PARTICLES. S. N. Vernov, A. M. Kulikov, and E. L. Feinberg. *Doklady Akad. Nauk S.S.S.R.* **80**, 871-4(1951). (In Russian)

An expression for the zenithal energy distribution of secondary cosmic radiation is derived, and calculated values are compared with experimental results. Energy lost to neutrinos by μ -meson decay is estimated.

3315

ON THE NATURE AND MECHANISM OF PRODUCTION OF PARTICLES OF EXTENSIVE ATMOSPHERIC COSMIC-RAY SHOWERS. L. Kh. Eïdus. *Doklady Akad. Nauk S.S.S.R.* **81**, 1035-8(1951). (In Russian)

Arguments are presented in favor of a nuclear-cascade process over an electron-photon process as an explanation of extensive atmospheric shower production.

3316

ON THE GALACTIC VARIATION OF COSMIC RAYS. Alice Daudin and Jean Daudin. *Compt. rend.* **234**, 1551-3(1952) Apr. 7. (In French)

Approximately zenithal Auger showers of 5- and 80-m extent, half arriving from within 18° of the vertical, were registered as a function of sidereal time over a period of 3 yr. No variation was found for the 5-m showers, but an amplitude anisotropy of $0.32 \pm 0.13\%$ was noted for the 80-m showers, the primaries of which have 10^{15} ev energy. The sidereal variation approximates that of galactic radio noise, a maximum occurring when the constellation Cygnus passes the zenith.

3317

IONIZATION SPECTRUM OF HARD COMPONENTS OF COSMIC RADIATION AT SEA LEVEL. A. G. Meshkovskii and V. A. Shebanov. *Doklady Akad. Nauk S.S.S.R.* **82**, 233-6(1952) Jan. 11. (In Russian)

The ionization spectra of the meson component of cosmic radiation was measured at sea level with stilbene scintillation counters and Pb absorbers. The spectra, with and without density corrections, are shown and compared with the literature.

3318

ON PARTICLES WITH MASSES OF 600 AND 1000 m_e IN COSMIC RADIATION. A. Alikhanyan, A. Dadayan, and N. Shostakovich. *Doklady Akad. Nauk S.S.S.R.* **82**, 693-6 (1952) Feb. 11. (In Russian)

Absorption experiments in magnetic fields of 6400, 9200, and 10,500 gauss showed the presence in cosmic radiation of particles with masses of ~ 600 and $\sim 1000 m_e$. Positive and negative charges were associated with each mass.

3319

INVESTIGATION IN THE STRATOSPHERE OF PROPERTIES OF PENETRATING PARTICLES OF COSMIC RADIATION. K. I. Alekseeva, S. N. Vernov, and R. M. Osokina. *Doklady Akad. Nauk S.S.S.R.* **80**, 725-8(1951). (In Russian)

A counter-telescope designed to register shower-producing particles with ranges between 4 and 8 cm of Pb is described. The composition of cosmic radiation having these limits at 15 to 20 km altitude was found to be 1.0 to 1.5 electrons and 1.0 proton or meson/min-sterad-cm².

3320

ON IONIZATION IN THE STRATOSPHERE PRODUCED BY VARIOUS COMPONENTS OF COSMIC RADIATION. N. L. Grigorov, I. M. Evreinova, and S. P. Sokolov. *Doklady Akad. Nauk S.S.S.R.* **81**, 379-82(1951). (In Russian)

Graphs of ion pairs produced per cc of air per sec by ionizing and relativistic particles from 5 to 25 km altitude are presented. The ionization chamber used is described briefly.

3321

ON THE NUCLEAR CASCADE PROCESS IN EXTENSIVE ATMOSPHERIC COSMIC-RAY SHOWERS. I. L. Rozental. *Doklady Akad. Nauk S.S.S.R.* **80**, 731-4(1951). (In Russian)

The distributions with atmospheric depth of components (nucleons, π and μ mesons, and electrons) of extensive showers are calculated by nuclear-cascade theory and compared with experiment in an attempt to evaluate certain constants in the theory.

3322

V^0 PARTICLES AND ISOTOPIC SPIN. D. C. Peaslee. *Phys. Rev.* **86**, 127-8(1952) Apr. 1.

Consideration is given to the implications of the assumption that the isotopic spin T is a good quantum number for meson-nucleon systems. The V^0 is considered as a nucleon in an excited state, and investigation of the conditions under which the V^0 could be absolutely stable leads to the following conclusions: The apparent failure to observe V^{++} and other companion particles with frequencies comparable to V^0 suggests that the V -particle wave functions have some (or all, if T is a good quantum number) components with $t < \frac{1}{2}$. This would mean that independent principles must be found to explain both the π - and γ -stability of these particles without help from isotopic-spin considerations which could have eliminated one type of instability. A direct check of t for the V^+ particles is in principle possible from a determination of the $(n + \pi^+): (p + \pi^0)$ ratio. The presence of V^- particles in the face of an established absence of corresponding V^{++} would suggest failure of T as a good quantum number.

3323

THE ABSORPTION RATE OF COSMIC-RAY NEUTRONS PRODUCING C^{14} IN THE ATMOSPHERE. Rudolf Ladenburg. *Phys. Rev.* **86**, 128(1952) Apr. 1.

Recalculations are made of the average integrated absorption rate of atmospheric neutrons. The recent measurements by Yuan (*Phys. Rev.* **81**, 175(1951)) and the best available neutron cross sections are used. The integrated number of all neutrons absorbed by the $N(n,p)C$ reaction in the atmosphere at 52° N is calculated to be 4.2/cm²-sec, and the value averaged over the earth's surface 2.4/cm²-sec, in approxi-

mate agreement with Anderson and Libby's (*Phys. Rev.* **81**, 64(1951)) value (2.23/cm²-sec) for the average number of disintegrating C atoms.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE 3324

Atomic Energy Research Establishment, Harwell, Berks (England)

STRAIN HARDENING OF SINGLE CRYSTALS, by P. L. Pratt. Mar. 14, 1952. 12p. (AERE M/R-883)

Certain features of the mechanism of deformation of sodium chloride have been observed which accounted for the particular shape of the strain-hardening curves. Glide on a single system was found to give linear hardening, whereas simultaneous glide on two systems gave a parabolic hardening curve. While it was not assumed that the detailed mechanism of deformation of ionic and metallic crystals was identical, the conclusions reached led to a further examination of the available evidence for metallic crystals, where similar results were found. These are shown to be in agreement with the latest theoretical predications. The formation of kink bands, and the existence of a yield point in single crystals, are discussed in terms of new evidence from transparent crystals. (auth)

3325

Utah Univ.

THERMOKINETIC MODELS FOR MAGNETISM, SOLID FRICTION AND PLASTIC FLOW OF CRYSTALS, by Peter Gibbs and Henry Eyring. May 1, 1951. 25p. (NP-3706; Technical Report No. 22; U17952)

The theory of rate processes is reviewed for those reactions in solids which can be approximated as a sequence of quasi-equilibrium states. The behavior of the system is correlated to its energy hypersurface in configuration space, or to a semiempirical thermokinetic model in 1 dimension. By establishing a thermokinetic model for the propagation of the Bloch magnetic-domain boundary, the critical field in the sixtus-Tonks experiment is interpreted as a free energy per magnetic-moment change in elementary processes. Thermokinetic models are also given for solid friction and the plastic flow of crystals. In the latter application the creation and propagation of dislocations must be considered; this gives rise to a multivalued reaction coordinate. The Cottrell and Aytakin formula for creep is obtained. (auth)

3326

RECRYSTALLIZATION OF ALUMINUM SINGLE CRYSTALS AFTER PLASTIC EXTENSION. N. K. Chen and C. H. Mathewson. *J. Metals* **4**, 501-9(1952) May.

Recrystallization of aluminum single crystals after plastic extension is carefully studied in relation to the structure of the deformed matrix. The shapes of the new grains are analyzed with regard to slip planes and to the presence or absence of deformation bands. A mechanism by which the orientations of the recrystallized grains are related to the parent lattice is described. (auth)

ELECTRONS

3327

THEORY OF SUPERCONDUCTIVITY. O. Klein. *Nature* **169**, 578-9(1952) Apr. 5.

Superconductivity will occur when electrons are only slightly disturbed by a magnetic field. The status of electrons energetically in the neighborhood of the normal state contain only a small percentage of electron excitation. For excitation energies small compared to the electron energy at the Fermi surface, $\Delta\epsilon/\epsilon = \hbar C^2 \epsilon^2 / 48 \pi m^2 v \sigma^2$, where $C \sim 10^{16}$ cm⁻², m the electron mass, v the electron velocity at the Fermi surface, σ the density of the metal, s the velocity of sound, ϵ the excitation energy, and $\Delta\epsilon$ the

accuracy of ϵ . The probability dP for the emission of a phonon of energy between ϵ and $\epsilon + d\epsilon$ per unit time is $dP = 4N\pi\alpha^2 e^4 d\epsilon / Mv\epsilon^2$, where N is the number of atoms per unit volume, M the mass of the atom, v the electron velocity at the top of the Fermi distribution, α a small fraction, and e the electronic charge. The fraction α can be calculated, and is of the order 0.001 to 0.01.

3328

RADIATION LOSS OF ELECTRONS IN THE SYNCHROTRON. H. Olsen and H. Wergeland. *Phys. Rev.* **86**, 123-4 (1952) Apr. 1.

The classical and quantum-mechanical calculations of the radiation from electrons in uniform circular motion in a homogeneous magnetic field are inspected. Parzen (*Phys. Rev.* **84**, 235(1951)) had calculated a total radiation loss considerably smaller than that expected from classical theory. It is shown in the present paper that the discrepancy between classical and quantum-mechanical results is negligible in the most important region of angle and frequency, and that Parzen's error was due to neglect of quantum numbers $l' > 0$ of the final state.

GASES

3329

Los Alamos Scientific Lab.

A SIMPLE THERMAL CONDUCTIVITY ANALYZER FOR ORTHO-PARA HYDROGEN, by E. R. Grilly. [nd] 4p. (AECU-1988; LADC-1137)

Apparatus is described which will measure the ortho-para composition of liquid hydrogen. The principle of the instrument is based on the difference in the gaseous thermal conductivity between the two forms of the gas. An analyzer suitable for most purposes can be easily made out of standard laboratory stock items.

INSTRUMENTS

3330

Los Alamos Scientific Lab.

SHORT-HAND CODING FOR THE IBM DEFENSE CALCULATOR, by Willard Bouricius. [nd] 4p. (AECU-1966; LADC-1139)

A short-hand coding system is described for the IBM defense calculator. The system takes the drudgery out of coding and at the same time is faster and more accurate than the usual long-hand coding systems.

3331

Los Alamos Scientific Lab.

GENERAL PURPOSE FLOATING DECIMAL PANELS FOR THE IBM CARD-PROGRAMMED ELECTRONIC CALCULATOR—MODEL II, by Sidney L. Lida. [nd] 8p. (AECU-1969; LADC-1141)

A three-factor two-operation control panel with automatic calculation of certain transcendental functions is described. The three factors are delivered to the calculator over Channel A, Channel B, and a new channel called X. The floating decimal notation used is explained, and the ability of the machine to perform various operations is indicated. Some specific available arithmetic functions and manipulative operations are tabulated.

3332

Argonne National Lab.

A DESIGN FOR AIR CORE MAGNETIC LENS COILS, by M. S. Freedman, W. J. Ramler, and B. Smaller. Mar. 10, 1952. 4p. (AECU-1995; UAC-538)

The design of two air-core magnetic-lens coils is described. Each coil consists of six pancake windings, 128 turns per pancake, and dissipates 19 kw continuously with an average temperature rise of 35°C. The constructional details including a cross-sectional drawing of the coils are also given.

3333

Oak Ridge National Lab.

EFFECT OF β , γ -RADIATION ON GLASS pH ELECTRODES; A PRELIMINARY INVESTIGATION, by J. H. Pannell. Apr. 8, 1952. 12p. (CF-52-4-156)

Continuous irradiation of glass pH electrodes has indicated their possible application in solutions containing about one curie of beta activity per milliliter. (auth)

3334

Los Alamos Scientific Lab.

RESPONSE OF ELECTRICAL CIRCUITS TO EXPONENTIAL DRIVING FORCES, by Walter H. Weber. Oct. 1951. 48p. (LA-1323)

This paper presents the steady-state theory of the response of both lumped constant and distributed-constant electrical circuits to an exponential driving voltage. The theory is very closely analogous to the familiar theory of alternating currents. The author has attempted to emphasize the few important differences between the two. (auth)

3335

Oak Ridge National Lab.

INSTRUMENT RESEARCH AND DEVELOPMENT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JULY 20, 1951. Issued Apr. 30, 1952. 17p. (ORNL-1159)

Progress made during the quarter ending July 20, 1951, for the instrument research and development program is reported. Numerical data are presented for the following projects: development of a hollow-crystal spectrometer, improvement of resolution of scintillation spectrometer, development of high-speed synchroscope, development of a mercury-relay pulse generator.

3336

Oak Ridge National Lab.

INSTRUMENT RESEARCH AND DEVELOPMENT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING OCTOBER 20, 1951. Issued Apr. 28, 1952. 15p. (ORNL-1160)

Brief notes are given on the instrument research and development program. The instruments discussed are: single- and multi-channel analyzers, scalars, scintillation counters, and modified resonance analyzer.

3337

Oak Ridge National Lab.

SNARE-TYPE HANDLING DEVICE, by J. R. Farmakes. Issued Apr. 28, 1952. 8p. (ORNL-1250)

The design of a snare-type handling device is described. A special hinge was designed to maintain the sample in a vertical position. The hinge axis is located on the center line of the cable that is carried in the horizontal arm at the point of intersection with the center line of the cable in the vertical arm. When the cable centers of the two arms make a right angle, the pulley center is located on a line bisecting the right angle and at a point such that the two cables are tangential to the pulley and in contact with it over a 90° arc. In normal use, this arrangement of hinge and pulley results in the exertion of minimum moments on the lower arm over the range of angular motion of the horizontal arm. The moment developed by cable tension needed to hold a container is essentially zero when the two arms are at right angles to each other. For other angles between the arms, the combined weights of the lower arm and a very small load are more than sufficient to offset the tendency to cause deflection of the lower arm from vertical.

3338

National Bureau of Standards

QUARTERLY PROGRESS REPORT OF THE OFFICE OF BASIC INSTRUMENTATION; FOR THE QUARTER ENDING DECEMBER 31, 1951. [nd] 41p. (NBS-1467; U21456)

Brief summaries of work are given for the following projects: cathode-ray-oscillograph beam intensification, determination of temperature with the noise thermometer,

medical physics instrumentation, anesthesia monitor, electron interferometer, mass spectrometer for study of solids, pulsed photomultiplier, electron coating thickness gage, CO₂ hypsometer, absolute measurement of vibration amplitudes, strain and displacement instruments, vacuum tube accelerometer, ultrasonic velocimeter for liquids, acoustic viscometer for gases, microwave hygrometer, mutual-inductance transducer, application of feed-back around image scanning systems, piezoelectric accelerometer, phase-sampling telemeter, spring transducer, pneumatic instruments based on critical flow, instrumentation for dynamic mechanical measurements, instrumentation utilizing magnetic effects on mechanical vibrations, a calibrated vacuum-leak instrument, humidity measurement by spectroscopic methods, and stability of feed-back systems. (cf. TIP U20260) (NRS abst.)

3339

RCA-Victor Div., Radio Corp. of America
RESEARCH INVESTIGATION OF IONIZATION CHAMBERS;
SECOND QUARTERLY REPORT; AUGUST 1, 1951–OCTOBER 31, 1951, by J. R. Parker. [nd] 40p. (NP-3703)

The need for a monochromatic, low-energy radiation source is briefly discussed. Shortcomings of simply filtered x-ray sources which are not disclosed in recent literature on the subject are considered. A part of the wall-effect study, done with sources which had decayed to within an order of magnitude of the background, is not included because of its very questionable worth. Measurements, techniques, and procedures developed to insure procurement of accurate data under this circumstance are discussed. However, because of the unknown and probably heterogeneous nature of the background radiation the data obtained could not be interpreted clearly. Difficulties in tracing leaks which developed in the gas system are described. Instructions are given for a revision of the valves that eliminated the last of these leaks. A new means is described for mounting the test chamber and electrometer-head which permits more accurate positioning of the test chamber. This, along with a rack for more accurate positioning of the secondary standard minometer, will make possible results of greater precision. A brief discussion is presented of the complications introduced by chamber design for increased sensitivity. An account is given of all the phenomena which a complete theoretical analysis should include. (auth)

3340

George Washington Univ.
ON THE PROBABILITY DISTRIBUTION OF THE NUMBER OF SECONDARY ELECTRONS, by Z. Bay and G. Papp. [nd] 8p. (NP-3765)

The probability distribution of the number of slow secondary electrons released from a substance after the incidence of a primary particle (electrons, ions, photons, etc.) is derived. It is also shown that this probability distribution can be completely determined by measuring the pulse-height distribution at the anode of a multistage electron multiplier tube. The method for obtaining this distribution is based on experimentally obtainable data and does not involve any assumptions about the uniform operation of the successive multiplying stages.

3341

Yale Univ.
A MILLISECOND TIMER, by Julian M. Sturtevant. Nov. 1, 1950. 12p. (NYO-802)

3342

Radiation Lab., Univ. of Calif.
CONSTRUCTION AND MAINTENANCE REPORT ON THE UCRL SYNCHRO DRIVEN DIFFERENTIAL ANALYZER, by Earl G. Sorensen. Feb. 1952. 74p. (UCRL-1717)

A general physical description of the analyzer is presented with emphasis on the components and accessories in view of

their theoretical and operational considerations. Electro-mechanical adjustments of critical components and methods of testing are also discussed. Presentation of the material consists of illustrations, diagrams, and data considered as a guide to continued useful service or possible duplication of the analyzer.

3343

A MICROSECOND INTERVAL TIMER. E. W. Titterton. *Rev. Sci. Instruments* 23, 96(1952) Feb.

A circuit was designed for the measurement of intervals as small as 0.1 μ sec. The design follows that of previous investigators, differing only in the use of an artificial transmission line of the lumped-constant low-pass-filter type. A schematic diagram of the circuit is discussed in detail.

ISOTOPES

3344

Atomic Energy Project, Univ. of Calif., Los Angeles
IRRADIATION CHAMBER FOR COBALT 60, by M. A. Greenfield, L. B. Silverman, and R. W. Dickinson. Issued Apr. 18, 1952. 19p. (UCLA-194)

A chamber has been designed and built to house a 100-curie source of Co⁶⁰. The chamber and cobalt source are to be used to irradiate chemical or small biological samples. (auth)

3345

Radiation Lab., Univ. of Calif.
RECENT STUDIES OF THE ISOTOPES OF EMANATION, FRANCIIUM AND RADIUM, by F. F. Momyer, E. K. Hyde, A. Ghiorso, and W. E. Glenn. Univ. of Calif. Radiation Lab. and Univ. Calif., Berkeley. Mar. 19, 1952. 6p. (UCRL-1734)

A method was developed for preparation of Pt plates with radon atoms so firmly affixed that counting techniques typical for non-gaseous radioactive samples could be employed. Half lives, α -particle energies, and branching ratios are tabulated for radon isotopes Rn²⁰⁹, Rn²¹⁰, Rn²¹¹, and Rn²¹². The apparent half lives of Fr²¹³, Fr²¹¹ and Fr isotopes of mass less than 211 are all shorter than 5 min. Evidence was found that Ra²¹³ (~2 min) decayed by α emission to Rn²⁰⁹ which in turn decayed by α emission to Po²⁰⁵ and by electron capture to At²⁰⁹. Observations on decay of Rn²²¹ are reported briefly.

MASS SPECTROGRAPHY

3346

Alabama Polytechnic Inst.
PROGRESS REPORT, by Howard Carr. Aug. 31, 1951. 30p. (ORO-62)

Completion and satisfactory operation of a mass spectrometer are reported. The design is discussed briefly. Preliminary results of a study of the positive ions resulting from the electron bombardment of a series of organic phosphorus compounds, namely triethyl phosphate, diethyl chlorophosphate, and ethyl dichlorophosphate, and data on negative ions manufactured while these compounds were under bombardment by 50-ev electrons are included.

3347

MASS SPECTROMETRY. I. THEORY AND CONSTRUCTION OF MASS SPECTROMETERS. II. KINETICS OF REACTION OF URANIUM WITH H₂, HD, and D₂. Harry J. Svec. Ph.D Thesis, Iowa State Coll., 1951.

The purpose of the present work was to construct a mass spectrometer that would operate in the range of 1 to 75 mass units. However, because of the special problems involved in the mass spectrometric assay of the hydrogen isotopes a separate machine was built for this purpose. The second spectrometer described covers the entire range 1 to 75 mass units. Work is reported on the reaction between finely divided U metal and H₂, HD, and D₂, the spectrometer being used to analyze the gases after they passed the metal.

MATHEMATICS

3348

Argonne National Lab.

THE NUMERICAL SOLUTION OF UNSTEADY-STATE HEAT CONDUCTION PROBLEMS BY THE METHOD OF CRANK AND NICOLSON, by George Leppert. Mar. 14, 1952. 18p. (AECU-1997; UAC-546)

A method is briefly reviewed for obtaining a numerical solution of the heat-flow equation which is not subjected to the limitations on the size of the time step. Although this discussion is primarily concerned with heat transmission, it is believed that this mathematical method will prove to be useful to workers in other fields of engineering design, such as for fluid flow calculations and for the study of electrical transients.

3349

Los Alamos Scientific Lab.

SELF-SERVICE USE OF THE IBM CARD-PROGRAMMED ELECTRONIC CALCULATOR AT LOS ALAMOS, by Allan Ingvald Benson. [nd] 5p. (AECU-1965; LADC-1140)

Development of floating point boards for IBM card-programmed electronic calculators increased the usefulness of these machines for physicists and mathematicians due to ease of coding, greater accuracy, speed of coding, and the opportunity to make an exponent check while the problem is running. The eight-digit floating-point control panels are used almost exclusively by personnel outside the computing group, who operate the machines on a self-service basis.

3350

Carbide and Carbon Chemicals Co. (K-25)

DETERMINING SECOND DEGREE CURVATURE, by A. de la Garza. Issued Mar. 24, 1952. 11p. (K-894)

The problem of spacing a specified amount of information in a specified range for the discrimination of second-degree curvature is analyzed. Optimum discrimination is given by placing one half the information at mid-range, the other half being distributed equally at the extreme ends of the range. (auth)

3351

Nuclear Development Associates, Inc.

ON ANGULAR MOMENTUM, by J. Schwinger. Harvard Univ. and Nuclear Development Associates, Inc. Jan. 26, 1952. 91p. (NYO-3071)

The commutation relations of an arbitrary angular momentum vector can be reduced to those of the harmonic oscillator. This provides a powerful method for constructing and developing the properties of angular momentum eigenvectors. In this paper many known theorems are derived in this way, and some new results obtained. Among the topics treated are the properties of the rotation matrices; the addition of two, three, and four angular momenta; and the theory of tensor operators. (auth)

3352

Oak Ridge National Lab.

TABLES OF THE RACAH COEFFICIENTS, by L. C. Biedenharn. Issued Mar. 21, 1952. 208p. (ORNL-1098)

The properties of the Racah coefficients are discussed. Five algebraic tables for the W coefficients and 108 numerical tables for W and Z functions are given.

MEASURING INSTRUMENTS AND TECHNIQUES

3353

Los Alamos Scientific Lab.

UNIFORM, NON-HYDROGENOUS, ZnS PHOSPHORS, by David O. Caldwell and John R. Armstrong. [nd] 5p. (AECU-1963; LADC-1158)

A method was developed for depositing ZnS from an alcohol dispersion, producing a thin, uniform layer containing no hydrogenous material and giving a quite uniform distribution of pulse heights for monoenergetic incident particles.

3354

RCA Victor Div., Radio Corp. of America

RESEARCH INVESTIGATION OF IONIZATION CHAMBERS; THIRD QUARTERLY REPORT NOVEMBER 1, 1951-JANUARY 31, 1952, by J. R. Parker. [nd] 63p. (NP-3723; U21593)

Data taken in the beginning of the quarter differ radically from earlier data. Most of this disparity is shown to have been caused by an internal failure of the vibrating-reed electrometer and by contamination of the gas system. Further considerations account for the remaining difference in the data. Curves are displayed comparing old and new data. Graphs of wall study are shown and discussed. Tests with a 140 kvp x-ray generator arranged to excite fluorescence radiation are described. Performance-wise the particular generator tested is found satisfactory and its purchase is recommended. Experimental data indicate that scattered radiation from the radiator exceeds the fluorescence radiation by a large factor. Pending the outgrowth of careful analysis of the experimental arrangement and mode of operation of the apparatus it is concluded that the use of paired absorbers, adjacent in atomic number and having critical absorption edges near the desired energy range, may be more satisfactory. (auth)

3355

Naval Research Lab.

DISTORTION OF TRANSIENTS IN THE CYLINDRICAL ION CHAMBER, by Arthur J. Ruhlig. 8p. Apr. 15, 1952. (NRL-3952)

By an analysis based on reasonable assumptions of the factors involved in the process by which ionization chamber converts a variation in electron density into an electrical signal, formulas have been derived from which the electron density can be calculated in the general case from the measurements of signal voltage. In addition, it has been shown how the resolution time may be decreased and the sensitivity increased. (auth)

3356

Carnegie Inst. of Tech.

DESIGN OF DOUBLE FOCUSING β -RAY SPECTROSCOPE AND APPLICATION TO INTERNAL CONVERSION IN Cu^{64} , by George W. Hinman. Nov. 1, 1951. 122p. (NYO-912)

The following work discusses the performance, construction, and use of several β -ray spectrometers. In particular the design and operation of a large double-focusing instrument is considered in detail. Experimental results obtained concerning the γ radiation from Cu^{64} are included. Two results related to the correction of β -ray spectra are also included in the appendices. (auth)

3357

GEIGER-MUELLER COUNTERS; CHARACTERISTICS OF FUNCTIONING AND USE. S. Colombo and L. Terra. *Radioterapia radiobiol. e fis. med.* 4, 315-33(1951). (In Italian)

The principle of the G-M counter is discussed, various types are described, and applications in radiotherapy are considered. 16 figures.

3358

ELECTRON VELOCITIES IN GIEGER COUNTER GAS MIXTURES. LETTER I. Alden Stevenson. *Rev. Sci. Instrum.* 23, 93(1952) Feb.

A coincidence counting arrangement is discussed by which the electron velocities in various gas mixtures were measured. Electrons ejected by a β particle at different points in its path through the gas were accelerated toward counter wires placed at different distances from the path. Elapsed time between pulses from the respective wires gave a measure of electron velocity vs. voltage and pressure. An argon-ether mixture was found superior to an argon-butane mixture.

3359

COINCIDENCE TIME DELAYS IN GEIGER COUNTERS. LETTER II. Alden Stevenson. *Rev. Sci. Instruments* **23**, 93-4(1952) Feb.

The experiment consisted in measuring the number of coincidences recorded whose separation in time was larger than a certain value. The G-M tubes used were 1.5 cm in diameter, contained an argon-ether mixture at a pressure of 7 cm Hg, operated 70 v above the threshold, and had a tungsten center wire. An arrangement to detect the delay times between two G-M tube pulses is described. The maximum transit time of an electron from the cathode to the avalanche region is 10^{-7} sec.

3360

SHORT DOUBLE COINCIDENCE RESOLVING TIMES FOR G-M TUBES. LETTER III. C. E. Mandeville. *Rev. Sci. Instruments* **23**, 94(1952) Feb.

Methods of measuring coincidence loss in G-M tubes are discussed. It is emphasized that, under suitable conditions, short coincidence resolving times may be used with no coincidence loss. Resolving times of $<10^{-7}$ sec are obtainable with argon-ether tubes of 1.5-cm diam.

3361

GENERAL OBSERVATIONS ON DISCHARGE LAG IN COUNTERS. LETTER IV. W. E. Ramsey. *Rev. Sci. Instruments* **23**, 95(1952) Feb.

The discharge lag in counters is briefly discussed. The scattering of β particles within the tube results in an unknown distribution of electron path lengths, making impossible the exact calculation of lag.

3362

DELAY TIMES IN G-M COUNTERS. LETTER V. W. C. Porter and W. E. Ramsey. *Rev. Sci. Instruments* **23**, 95-6(1952) Feb.

This experiment extended the work of A. Stevenson (see abstract for Letter II above) on delay times in G-M counters. Maximum delay time and the effect of counter size are discussed.

3363

AN INSTRUMENT FOR THE RAPID DETERMINATION OF IONIZATION EFFICIENCY CURVES USING THE MASS SPECTROMETER. G. R. Hercus and J. D. Morrison. *Rev. Sci. Instruments* **23**, 118-20(1952) Mar.

An instrument is described which carries out automatically the measurement of ionization efficiency curves using the mass spectrometer. It operates by applying a scanning signal to the ion-accelerating voltage, while the ionizing-electron voltage is reduced by a motor-driven potentiometer, and a voltage measuring unit prints voltage calibration marks on the mass spectrometer record. The time taken for a complete measurement is of the order of a few minutes. (auth)

3364

ELIMINATION OF COINCIDENCES CAUSED BY BACK-SCATTERING OF ELECTRONS IN AN ARRANGEMENT OF OPEN-END COUNTERS. RESULTS FOR P^{32} AND S^{35} . Maurice Duquesne. *Compt. rend.* **234**, 1159-61(1952) Mar. 10. (In French)

Coincidences observed while measuring the radiations of P^{32} and S^{35} sources supported between two open-end G-M counters were found to be caused almost entirely by back-scattering from the support. By varying the support area and extrapolating the ratio coincidences/disintegrations to the limit of zero area, limiting ratios of only $2.5 \pm 0.7 \times 10^{-4}$ and $0.8 \pm 0.7 \times 10^{-4}$ were found for P^{32} and S^{35} , respectively.

3365

ON A PHOTOMETRIC METHOD OF IDENTIFICATION OF PARTICLES WITH ELECTRONIC CHARGE IN THICK PHOTOGRAPHIC EMULSIONS. Georges Kayas and Daniel

Morellet. *Compt. rend.* **234**, 1359-61(1952) Mar. 24. (In French)

A photomultiplier arrangement by which the optical transmission of tracks in nuclear emulsions may be studied is described. Relative oscilloscope impulse heights are plotted as a function of range in 600- μ -thick Ilford G5 emulsion for deuterons, protons, π and μ mesons, and α particles.

3366

USE OF NUCLEAR PLATES FOR THE DETERMINATION OF THE URANIUM AND THORIUM CONTENTS OF RADIO-ACTIVE ORES. J. H. J. Poole and C. M. E. Matthews. *Nature* **169**, 408-9(1952) Mar. 8. (cf. NSA 6-2160)

A method for field analysis of radioactive ores is given which makes use of photographic plates for determination of Th/U ratio by measuring the horizontal lengths of α -ray tracks. The Th/U ratio is equal to $3.6/(n_1/n_2 - 2.15)$, where n_1 is the number of tracks with horizontal length exceeding the maximum range of RaC' and n_2 is the number of tracks with horizontal length lying between the maximum ranges of RaC' and ThA. The method gives only approximate results.

MESONS

3367

Radiation Lab., Univ. of Calif.

THE POSITRON SPECTRUM FROM THE DECAY OF THE μ MESON (thesis), by Harmon William Hubbard. Mar. 10, 1952. 48p. (UCRL-1623)

Mesons from the reaction $p + p \rightarrow \pi^+ + d$ were allowed to enter an expansion cloud chamber containing several thin C plates. When a π^+ meson was slowed down and stopped in one of the plates, the μ meson also normally decayed while in the C, and the decay positron emerged into the gas of the cloud chamber. Some μ mesons previously formed by π decay in flight were also stopped in the C plates, the positron again emerging. The identification of the μ -decay positrons depended on finding the conjunction of a heavily ionized meson track and a lightly ionized positron track at some point on one of the plates. The energies of the positrons were measured from the photographs of the tracks on the film with the aid of a stereoscopic projector. The theory of the decay process is briefly considered, and theoretical curves are compared with the experimental energy spectrum.

3368

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF DECEMBER 20, 1951, by Sergey Shewchuck. Mar. 7, 1952. 6p. (UCRL-1696)

μ^- Endings in Photographic Emulsions. by Dora Sherman. A μ^- beam was obtained from the 184-in. cyclotron by bombarding a Be target with protons. The bombardment produces π^- mesons which decay in the vicinity of the target to give a diffuse μ^- beam. A channel collimated the particles from the target region. An absorber was used to filter out the π^- mesons. A graph is given showing the energy distribution of μ^- mesons. About 240 mesons were studied and the results tabulated showing the correction factor applied for π contamination, using the star-prong distribution of Adelman and Jones. The Positron Spectrum from the Decay of the μ Meson. by Harmon Hubbard. μ decay positrons were detected in a cloud chamber and the energy distribution measured. The average energy of the positrons was 34.2 ± 1 Mev. An analysis of the positron spectrum on the basis of Michel's theory yielded a value of the parameter $\rho = 0.26 \pm 0.26$.

3369

NOTE ON THE BLOCH-NORDSIECK'S METHOD. Gyo Takeda, Yasutaka Tanikawa, Tosiya Tanluti, and Keiiti Saeki. *Progress Theoret. Phys. (Japan)* **6**, 994-9(1951) Nov.-Dec.

The convergence character of the Bloch-Nordsieck method as applied to the mesonic system is determined. The method is also shown to be based on the current perturbation method. Thus the B-N method will be unsuccessful if the perturbation treatment is found incorrect.

3370

SCATTERING AND ABSORPTION OF π -MESONS IN CARBON. H. Byfield, J. Kessler, and L. M. Lederman. *Phys. Rev.* **86**, 17-21(1952) Apr. 1.

The interactions of positive and negative π mesons of 62 Mev with carbon nuclei were studied in a magnet cloud chamber, using the external beams of the Nevis cyclotron. A Coulomb-nuclear interference is observed in the elastic scattering. This establishes that the nuclear potential is attractive for mesons. Nuclear cross sections obtained are $\sigma_{\text{abs}} = 181 \pm 22$ mb, $\sigma_{\text{el sc}} = 148 \pm 30$ mb. A complex square well model for the nucleus is considered. (auth)

3371

MESON-NUCLEON SCATTERING AND NUCLEON ISOBARS. Keith A. Brueckner. *Phys. Rev.* **86**, 106-9(1952) Apr. 1.

The scattering (including charge exchange) of π^- mesons in hydrogen rises from 18 millibarns at 60 Mev to a broad plateau of about 60 millibarns at 200 Mev, and is smaller than the π^+ scattering at 60 Mev in the ratio of 0.63 ± 0.09 . The general features of the π^- scattering, except for the high-energy plateau, are given qualitatively by pseudoscalar theory with pseudovector coupling in the weak coupling limit; the ratio of π^- to π^+ scattering predicted by this theory in the weak coupling limit is, however, 1.67, which is much higher than the experimental result. A phenomenological theory of the scattering is developed by using the methods of Wigner and Eisenbud and imposing the restrictions of charge symmetry. By using the qualitative assignment of the resonance-levels parameters as given by weak and strong coupling theory, satisfactory agreement with experiment is obtained. It is concluded that the apparently anomalous features of the scattering can be interpreted to be an indication of a resonant meson-nucleon interaction corresponding to a nucleon isobar with spin $\frac{1}{2}$, isotopic spin $\frac{1}{2}$, and with an excitation of 277 Mev. (auth)

3372

ANGULAR DISTRIBUTION OF π^+ PRODUCTION IN n-p COLLISIONS. H. A. Bethe and N. Austern. *Phys. Rev.* **86**, 121-2(1952) Apr. 1.

It is suggested that production of charged mesons by collisions between neutrons and protons may provide a sensitive test for the type of coupling between meson field and nucleons. The transition matrices developed by Chew, Goldberger, Steinberger, and Yang (*Phys. Rev.* **84**, 581 (1951)) and by Watson and Brueckner (*Phys. Rev.* **83**, 1(1951)) are considered, and it is concluded that near-isotropy would favor the former while a strong anisotropy would indicate some such theory as the latter.

3373

A SEARCH FOR NEW MESONS BY MEANS OF A CLOUD CHAMBER. M. Inoki, T. Yasaki, and Y. Matsukawa. *Phys. Rev.* **86**, 129-30(1952) Apr. 1.

The β -decay probability of slow mesons in the soft component of the cosmic radiation at 300 m altitude has been measured by means of a cloud chamber containing a thin C plate as stopping material. The cloud chamber was controlled by 2 proportional counters; the pulse sizes were recorded on photographic films by using a cathode-ray tube. Stereoscopic cloud-chamber photographs were taken with 2 cameras. Twenty-seven particles were stopped in the C plate; decay electrons were not observed from the 16 particles which appear to be mesons or from the 11 unidentified particles, except for 2 obscure thin tracks emerging from each of 2 mesons. It is assumed that the particles are new

mesons stable against β decay unless μ mesons have a mode of decay hitherto unknown.

3374

ON DISINTEGRATION OF BERYLLIUM BY MESONS. A. P. Zhdanov, P. I. Lukirskii, and Z. S. Sokolova. *Doklady Akad. Nauk S.S.S.R.* **80**, 729-30(1951). (In Russian)

Three events observed in nuclear emulsions loaded with Be and exposed to cosmic radiation are illustrated. The paths of only the incident particle and a single recoil particle are visible. The events are attributed to the reactions $\text{Be}^9 + \pi^- \rightarrow \text{Li}^7 + 2n + 121.3$ Mev and $\text{Be}^9 + \pi^- \rightarrow \text{Li}^6 + 3n + 144$ Mev.

3375

ON π -MESON DECAY. B. Ioffe and A. Rudik. *Doklady Akad. Nauk S.S.S.R.* **82**, 359-60(1952) Jan. 21. (In Russian)

In connection with recent studies on the decay of π mesons in nuclear emulsions (Fry, *Phys. Rev.* **83**, 1268(1951); NSA 5-7216), an expression for the ratio of the probability W of π -meson decay into μ meson + neutrino + γ quantum to that of decay into μ meson + neutrino is derived. The following calculated values for this ratio are given as a function of the ratio of the range R of the μ meson in the three-particle decay to its range R_0 in the two-particle decay.

| R/R_0 | $W_{\mu+\nu+\gamma}/W_{\mu+\nu}$ |
|---------|----------------------------------|
| 0.2 | 0.1×10^{-4} |
| 0.3 | 0.24×10^{-4} |
| 0.4 | 0.52×10^{-4} |
| 0.5 | 0.88×10^{-4} |
| 0.6 | 1.3×10^{-4} |
| 0.7 | 1.9×10^{-4} |
| 0.8 | 2.8×10^{-4} |
| 0.9 | 4×10^{-4} |

3376

ON ELECTRONS ARISING FROM DECAY OF FAST MESONS. S. A. Azimov, V. F. Vishnevskii, and K. P. Ryzhkova. *Doklady Akad. Nauk S.S.S.R.* **83**, 55-8(1952) Mar. 1. (In Russian)

Cosmic-ray-absorption experiments in air, graphite, and water at 2240- and 3900-m altitudes showed that only one-third, not one-half, of the energy of fast-meson decay appears as electron energy, indicating that these mesons decay into three, not two, particles. Analogous energy considerations suggest that the neutral particles arising in meson decay cannot be photons.

3377

EXPERIMENTAL STUDY OF THE IONIZATION PRODUCED IN GAS BY HIGH-ENERGY MESONS. Jean Becker, Paul Chanson, Eugène Nageotte, Terence Price, Pamela Rothwell, and Pierre Treille. *Compt. rend.* **234**, 1155-7(1952) Mar. 10. (In French)

The momentum and specific ionization of cosmic-ray π and μ mesons were measured simultaneously with a Wilson cloud chamber and Kr-filled proportional counters at Chamonix (3650 m). A total of 800 observations over the energy range 0.17 to 5 beV/c indicated a minimum ionization at ~ 400 Mev/c by a logarithmic increase at higher momenta.

METEROROLOGY

3378

Brookhaven National Lab.
WIND TUNNEL TESTS ON SEVEN AEROVANES, by Daniel A. Mazzarella. [nd] 17p. (BNL-1142)

Each of the aerovanes used on the 420-foot meteorology tower at Brookhaven has been tested in one, or more, wind tunnels. An equation of motion is defined. Comparisons are offered in terms of the period of each instrument and its damping coefficient. Other comparisons include starting

speeds, stopping speeds, and the effects of aging and unbalance on the performance of aerovane propellers. The effect of yaw on the readings of windmill-type anemometers has been investigated further. An expression is given for the relationship between true speed, indicated speed, and angular displacement. The recovery time of an aerovane propeller from rest, at several speeds, can be expressed by a hyperbolic equation. (auth)

MICROWAVES

3379

Duke Univ.

QUARTERLY PROGRESS REPORT; MICROWAVE RESEARCH; MAY 1, 1951–AUGUST 1, 1951, by Walter Gordy. [nd] 65p. (NP-3712; U20960)

Precise frequency measurements on rotational transitions occurring in the wavelength range from 2 to 3 mm for a number of molecules have been made. From these measurements, centrifugal stretching effects have been determined and accurate values of the rotational constants obtained. A table including all frequencies measured in this region of the spectrum is given. From measurements on the $J = 0 \rightarrow 1$ transition of $\text{CH}_3\text{Cl}^{36}$ the spin of 2 for Cl^{36} has been unquestionably established. The quadrupole moment of Cl^{36} has been determined as $-0.0168 \pm 0.0001 \times 10^{-24} \text{ cm}^2$. King, Hainer, and Cross's δ expansion for the energy levels of asymmetric top molecules near the prolate symmetric rotor limit are extended to terms in δ^4 and δ^5 . From microwave measurements of their rotational spectra the structures of POF_3 , PSF_3 , POCl_3 and PSCl_3 are reported. A molecular beam modulation method in microwave spectroscopy is described. The method is based on the principle of periodic mechanical interruption of a beam of molecules which are sprayed across the path of microwave radiation. Theoretical calculations indicate that sufficient sensitivity can be obtained to observe the spectrum of many heavy substances.

3380

Duke Univ.

QUARTERLY PROGRESS REPORT; MICROWAVE RESEARCH; NOVEMBER 1, 1950 – FEBRUARY 1, 1951, by Walter Gordy. [nd] 55p. (NP-3713; U18857)

3381

Princeton Univ.

COMPLETENESS RELATIONS FOR LOSS-FREE MICROWAVE JUNCTIONS, by T. Teichmann. Mar. 4, 1952. 32p. (NYO-3007)

Using a method which is the electromagnetic analog of the scattering matrix formalism in the theory of nuclear reactions, two "sum rules" are derived for the frequency-independent coefficients occurring in the admittance matrix relating the currents and voltages in a loss-free microwave junction. These are sums respectively over the various modes of the guides entering the junction, and over the modes of the cavity comprising the junction (suitably defined). The results are used to estimate the effect on the admittance matrix of the higher modes, both of the guides and of the junction proper. (auth)

MOLECULAR PROPERTIES

3382

Notre Dame Univ.

MECHANISM OF BOND RUPTURE IN HBr^{80} FOLLOWING ISOMERIC TRANSITION, by John L. Magee and E. F. Gurnee. [nd] 17p. (AECU-1981)

It was demonstrated that only a fraction of HBr^{80} and DBr^{80} bonds are ruptured following isomeric transition in Br^{80} . It is known that this transition is completely converted and from past theoretical work it is to be expected that all Br^{80} atoms should be separated from chemical combination. This

paper presents a brief theoretical consideration of the rupture mechanism in HBr^{80} in an attempt to understand why the rupture does not always occur. Approximate potential energy curves for some of the various molecular ions HBr^{+Z} which form during the Auger shower following conversion have been constructed. It is found that these ions all have lowest electronic states which are stable with respect to the dissociation process $\text{HBr}^{+Z} \rightarrow \text{H}^+ + \text{Br}^{+(Z-1)}$ and the possibility for non-rupturing is thus qualitatively explained for the charging process, since the entire charging time is short compared with molecular collision time in the gas phase. A further necessary condition for non-rupturing is that the ions can be discharged in collisions without rupture. This process is also considered briefly. The complete rupture of the C-Br⁸⁰ bond (in $\text{CH}_3\text{Br}^{80}(\text{g})$) is also considered and explained qualitatively. In this case no stable molecular states exist for the ions and rupture occurs during the charging process.

3383

Duke Univ.

QUARTERLY PROGRESS REPORT; MICROWAVE RESEARCH; FEBRUARY 1, 1951 – MAY 1, 1951, by Walter Gordy. [nd] 74p. (NP-3711)

The absorption line of oxygen which has been theoretically predicted in the 2.5 mm region was detected. Its position, line breadth, and Zeeman pattern were measured. A theoretical study was made of the quadrupole moments of N_2 and O_2 on the basis of molecular orbital theory. The results are in reasonable agreement with measurements of the moments in this laboratory. Paramagnetic resonance absorption in approximately a hundred salts in the powder form, containing atoms of the iron and rare-earth groups and organic as well as inorganic radicals, has been investigated. The frequencies employed range from 9,000 to 50,000 Mc. Exchange interaction which affects markedly the line widths and shape was found to be of wide occurrence even in ions separated by large organic radicals. The results indicate that paramagnetic resonance is a promising new method of investigating the orbital properties of these organic radicals. Evidence has been found in copper acetate for the simultaneous transition of electrons in neighboring ions with the absorption of a single quantum.

NEUTRONS

3384

New York Operations Office, AEC

REACTIVITY TEST FACILITY FOR URANIUM SLUGS; PART I. PRELIMINARY REPORT OF A NON-CRITICAL ASSEMBLY, by Richard Hochschild. Oct. 15, 1951. 28p. (NYO-3406)

Preliminary calculations are made to determine the optimum geometry and necessary neutron-source strength for a noncritical assembly capable of detecting differences between the thermal neutron absorption cross section of U samples to a precision of one part in 10^4 . Two alternative geometries are considered and contrasted. The optimum sample geometry is found to be that approximating a spherical shell of about 10-cm radius and 1.5-cm thickness, enclosing a neutron detector, and surrounded by a concentric shell source about 20 cm in radius. The space between source and sample is filled with moderator. If D_2O is used but no reflector or enriched U, the source strength necessary to achieve the desired precision is estimated to be on the order of 6×10^8 fast neutrons per second, about 30 curies of Ra-Be. Such an assembly is comparatively insensitive to dimensional variations between samples and to errors in positioning. A detecting circuit employing an enriched BF_3 ionization chamber can be designed to have the necessary stability and efficiency. The results indicate that such a

noncritical assembly is feasible, but it is doubtful whether any economy would be achieved over an enriched-U critical assembly.

- 3385 ON THE POSSIBILITY OF AFFECTING THERMAL NEUTRON CROSS SECTIONS. Giovanna Mayr. *Atti soc. nat. e mat. Modena* 82 (1951). 3p. (In Italian)

It is suggested that for the case of a flux of thermal neutrons striking a target, movement of the target in a direction perpendicular to that of the neutrons may alter the cross-section values. The scattering cross section especially should be considered when the neutrons meet a heterogeneous substance under conditions such that they would be expected to diffuse in an isotopic distribution; because of the mentioned effect they may show a preferred direction.

NUCLEAR PHYSICS

- 3386 Rochester Univ.
HIGH ENERGY PHYSICS PROGRAM; FINAL REPORT JULY 1, 1949 TO AUGUST 31, 1950. [nd] 113p. (AECU-1956)

- 3387 Bartol Research Foundation, Franklin Inst.
FIRST ANNUAL REPORT OF THE WORK OF THE BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE. Sept. 30, 1951. 313p. (NP-3729)

A review is given of the work completed or in progress from Oct. 1, 1950 to Sept. 30, 1951. The review consists of articles on (1) cosmic rays—investigation at very high altitudes, observations of the latitudes effect at high altitudes, experiments with photographic plates, and redetermination of mean life of the mesotron as a function of momentum; (2) nuclear physics—instruments and some nuclear reactions relating to the Van de Graaff Generator, radioactivity, development conversion counters, and the large Van de Graaff generator; and (3) linear accelerator. All work described is or will be published in suitable form in various scientific journals. Reprints of published reports or copies of reports to be submitted for publication are included in the report.

- 3388 ON APPLICATIONS OF RADIOACTIVE ISOTOPES (PROPOSAL FOR NEW RESEARCH). Giovanna Mayr. *Atti soc. nat. e mat. Modena* 82 (1951). 3p. (In Italian)

It is suggested that differences in nuclear reactions may occur in a target exposed to radiation if the target element, instead of being stable, is in an unstable state, as may be the case for β^- or β^+ emitters or natural γ emitters such as Po^{210} .

- 3389 DEUTERON REACTIONS WITH SEPARATED MAGNESIUM ISOTOPES. J. Ambrosen. *Nature* 169, 408(1952) Mar. 8.
Isotopic samples of magnesium of 15 to 90 $\mu\text{g}/\text{cm}^2$ were bombarded with deuterons of 1.9 Mev, the protons emitted at an angle of 90° being detected in a photographic emulsion. The results are presented in a table giving the process, range, energy, Q value, level, and relative intensity. The three reactions studied were $\text{Mg}^{24}(\text{d},\text{p})\text{Mg}^{25}$, $\text{Mg}^{25}(\text{d},\text{p})\text{Mg}^{26}$ and $\text{Mg}^{26}(\text{d},\text{p})\text{Mg}^{27}$.

NUCLEAR PROPERTIES

- 3390 Los Alamos Scientific Lab.
CROSS SECTION OF THE $\text{D}(\text{T},\text{n})\text{He}^4$ REACTION FOR 80 TO 1200 KEV TRITONS, by H. V. Argo, R. K. Adair, H. M. Agnew, A. Hemmendinger, W. T. Leland and R. F. Taschek. [nd] 3p. (AECU-1964; LADC-1122)

The reaction $\text{D}(\text{T},\text{n})\text{He}^4$ for incident tritons having energies ranging from 80 to 1200 kev is discussed. Essentially no numerical data are given.

3391

Argonne National Lab.

ACTIVATION CROSS SECTIONS MEASURED WITH ANTIMONY-BERYLLIUM PHOTONEUTRONS (thesis), by Clyde W. Kimball. Mar. 1952. 8p. (AECU-1975; UAC-548)

The activation cross sections of Cu^{63} , W^{186} , Co^{59} , and Ge^{74} have been measured by using photoneutrons of ~ 35 kev from an Sb-Be source. The source was made of concentric cylinders, the Be surrounding the Sb which had been irradiated in the Argonne heavy-water reactor. The following natural atom cross sections were obtained: Cu^{63} , 290 mb; W^{186} , 243 mb; Co^{59} , 386 (max) mb; and Ge^{74} , 98 mb. Errors in the cross-section values vary from 12 to 25%.

3392

Wisconsin Univ.

TOTAL CROSS SECTIONS OF HEAVY NUCLEI FOR FAST NEUTRONS, by D. W. Miller, R. K. Adair, C. K. Bockelman and S. E. Darden. [nd] 30p. (AECU-1989)

An abstract of this report was indexed as report AECU-1614 and appears in *Nuclear Science Abstracts* as NSA 5-63

3393

Los Alamos Scientific Lab.

ENERGY SPECTRUM OF NEUTRONS FROM THERMAL FISSION OF U^{235} , by B. E. Watt. [nd] Decl. Apr. 25, 1952. 18p. (AECU-3359; LADC-1156)

A proton recoil counter has been used to determine the neutron spectrum, in the energy range 3.3 to 17 Mev, of a beam produced by irradiating 95 percent U^{235} (metal) in the central experimental hole of the Los Alamos Homogeneous Reactor. Most of the fissions were induced by slow neutrons. The data are combined with those obtained by D. Hill and by T. W. Bonner, R. A. Ferrell and M. C. Rinehart; the composite spectrum so obtained extends from 0.075 to 17 Mev. Fits with two general formulas are discussed. (auth)

3394

Columbia Univ.

THE SPIN AND QUADRUPOLE MOMENT OF O^{17} , by S. Geschwind, G. R. Gunther-Mohr and G. Silvey. Mar. 5, 1952. 16p. (NYO-985)

This material appeared in *Phys. Rev.* 85, 474-7(1952) and was abstracted in *Nuclear Science Abstracts* as NSA 6-2470

3395

Columbia Univ.

THE SPIN AND QUADRUPOLE MOMENT OF Se^{79} , by W. A. Hardy, G. Silvey and C. H. Townes. Mar. 5, 1952. 7p. (NYO-985)

The nuclear spin of the radioactive nucleus Se^{79} was determined as $\frac{7}{2}$ by observing the quadrupole pattern of the $J = 2 \rightarrow 3$ transition in $\text{O}^{16}\text{C}^{12}\text{Se}^{79}$. Six hyperfine components were identified. Their frequencies are tabulated and compared with predicted frequencies for a spin of $\frac{7}{2}$ and a quadrupole coupling constant (eqQ) of 754 Mc. Estimating the molecular field gradient q ($q = \partial^2 V / \partial z^2$) for Se in OCSe one obtains the Se^{79} quadrupole moment $Q = 1.2 \times 10^{-24} \text{ cm}^2$ with an error less than 50%.

3396

NONLINEAR MESON THEORY FOR HEAVY NUCLEI.

Bertram J. Malenka. *Phys. Rev.* 86, 68-72(1952) Apr. 1.

A potential well somewhat between a three-dimensional isotropic oscillator and a square well is determined by using a nonlinear meson theory for heavy nuclei in their ground states. The introduction of a phenomenological spin-orbit coupling is shown to group the energy levels obtained according to the magic numbers. Finally, it is shown that the existence of nuclear shell structure seems to imply a modification in the concept of constant nuclear density for heavy nuclei. (auth)

3397

THE MAGNETIC MOMENT OF K^{40} AND THE HYPERFINE STRUCTURE ANOMALY OF THE POTASSIUM ISOTOPES.

J. T. Eisinger, B. Bederson, and B. T. Feld. Phys. Rev. **86**, 73-81(1952) Apr. 1.

The nuclear magnetic moment and atomic hyperfine splitting of K^{40} have been measured by the atomic-beam magnetic-resonance technique. Detection of K^{40} atoms, from a source of normal potassium, was achieved by employing a conventional surface ionization detector as the ion source for a mass spectrometer, and by utilizing an electron multiplier to count the K^{40} ions. By measuring the frequencies of appropriate lines in the Zeeman pattern, the nuclear moment was determined to be $\mu_1 = -1.2964 \pm 0.0004$ n.m. The hyperfine splitting in the ground state was redetermined to be $\Delta\nu = 1285.790 \pm 0.007$ Mc. The ratio of the nuclear g factors of K^{39} and K^{40} was measured directly by observing, in the same homogeneous magnetic field, H, the frequencies of two lines (a doublet) in the Zeeman spectrum of each isotope. The ratio of the doublet splittings yielded $|g(K^{40})/g(K^{39})| = 1.24346 \pm 0.00024$. From these results and from the previously measured $\Delta\nu(K^{39})$, the hyperfine structure anomaly of these K isotopes is

$$\frac{\{[2I(K^{40}) + 1]g(K^{40})\Delta\nu(K^{39})/[2I(K^{39}) + 1]g(K^{39})\Delta\nu(K^{40})\} - 1}{(0.466 \pm 0.019) \%}$$

The theory of the hyperfine structure anomaly is applied to the interpretation of this result. The contribution of K^{40} to the hfs anomaly seems to be (fortuitously) insensitive to the differences between the models investigated. (auth)

3398

RECENT RESULTS ON THE ISOTOPE-SHIFT EFFECT IN ATOMIC SPECTRA. Peter Brix and Hans Kopfermann. p.17-49 in Festschrift zur Feier des 200jährigen Bestehens der Akademie der Wissenschaften in Göttingen, 1951, Mathematisch-Physikalische Klasse. The Academy, Göttingen, [1951]. (In German)

A detailed, informative review is presented of recent experimental results, theoretical developments, and applications to atomic and nuclear physics of isotope shifts. 135 references

3399

THE ISOTOPE SHIFT BETWEEN RaD AND THE STABLE LEAD ISOTOPES. P. Brix, H. v. Buttlar, F. G. Houtermans, and H. Kopfermann. Nachr. Akad. Wiss. Göttingen Math.-physik. Klasse IIa Abt., No. 7(1951). 2p. (In German)

The isotope shift between pure RaD (Pb^{210}) prepared from Rn and Pb^{206} was measured spectroscopically, giving $\Delta\nu = (225 \pm 4) \times 10^{-3} \text{ cm}^{-1}$. Taking the average of the literature values of the $Pb^{206} - Pb^{208}$ shift as $(90 \pm 2) \times 10^{-3} \text{ cm}^{-1}$ gives the ratio $(Pb^{208} - Pb^{210})/(Pb^{206} - Pb^{208}) = 1.5 \pm 0.1$. A break in the isotope shift curve at the magic number $N = 126$ is thus established.

3400

ON THE ISOTOPE SHIFT IN THE BARIUM SPECTRUM. Hans Kopfermann and Günter Wessel. Nachr. Akad. Wiss. Göttingen Math.-physik. Klasse IIa Abt., No. 3(1951). 5p. (In German)

The intensity distribution of the 5536-Å resonance line of Ba I ($^1S_0 - ^1P_1$) was measured with an atomic-beam apparatus. A graph of the intensity vs. wave number exhibits an unsymmetry resulting from the presence of Ba^{136} and Ba^{134} . This is contrary to the isotope-shift determinations of Arroe (Phys. Rev. **79**, 836(1950); NSA 4-5966), which give a smooth intensity curve showing only the main Ba^{138} peak. Possible errors are discussed.

3401

MAGIC NUMBERS AND NUCLEAR MAGNETIC MOMENTS. Georges J. Béné. J. phys. radium **13**, 161-8(1952) Mar. (In French)

The various theories that have been proposed since 1937 to explain the regularities observed in the distribution of nuclear magnetic moments in the periodic table are discussed critically. Recent developments permit prediction of an unknown magnetic moment, often to within several per cent. The importance of these predictions in experimental research on nuclear moments, particularly by paramagnetic resonance, is stressed. 40 references

3402

DISTRIBUTION OF MECHANICAL AND MAGNETIC NUCLEAR MOMENTS IN A PERIODIC SYSTEM OF ISOTOPE GROUPS. E. P. Ozhigov. Zhur. Obshchei Khim. **21**, 1749-53(1951) Oct. (In Russian)

Construction of a periodic table on which isotopes are grouped and moments and spins are given is described. Correlation with the nuclear shell model is shown clearly.

NUCLEAR REACTORS

3403

North Carolina State Coll. School of Engineering
FURTHER DESIGN FEATURES OF THE NUCLEAR REACTOR AT NORTH CAROLINA STATE COLLEGE, by Clifford Beck, A. C. Menius, Jr., R. L. Murray, Newton Underwood, A. W. Waltner and George Webb. Jan. 1952. 82p. (AECU-1986; NCSC-46)

The design of a small nuclear reactor to be built on the campus of North Carolina State College is discussed. The report presents a general description of the reactor building, plans for the reactor components, reactor operating characteristics, hazards and safety precautions, and anticipated start-up procedures and operating policies.

3404

Oak Ridge School of Reactor Tech., Oak Ridge National Lab.
SIMPLIFIED REACTOR THEORY LECTURE SERIES.
LECTURE I. BULK CONSERVATION OF NEUTRONS, by J. M. Stein. Oak Ridge School of Reactor Tech., Oak Ridge National Lab. and Westinghouse Electric Corp. May 10, 1951. 17p. (CF-51-11-113, Lecture I)

NUCLEAR TRANSFORMATION

3405

Los Alamos Scientific Lab.
DISINTEGRATION OF Li^6 BY FAST NEUTRONS, by F. L. Ribe. [nd] 4p. (AECU-1971; LADC-1123)

The cross section of the $Li^6(n, \alpha)H^3$ reaction has been determined at neutron energies of 2.5 and 14 Mev. The three reactions resulting in the three isotopes of hydrogen are $Li^6(n, \alpha)H^3$ ($Q = 4.780$ Mev), $Li^6(n, d)He^5$ ($Q = -2.35$ Mev), and $Li^6(n, p)He^6$ ($Q = 2.433$ Mev).

3406

Oak Ridge National Lab.
 Mo^{99} , Ag^{111} AND Ba^{140} YIELDS FROM PROTON INDUCED FISSION, by W. H. Jones, J. L. Fowler and J. H. Paehler. [nd] Decl. Apr. 24, 1952. 10p. (AECU-3356)

An abstract of this report was indexed as report AECU-3306 and appears in Nuclear Science Abstracts as NSA 6-1856.

3407

Radiation Lab., Univ. of Calif.
INELASTIC EVENTS INDUCED BY 32 MEV PROTONS ON HELIUM (Thesis), by Jacob Benveniste. Mar. 31, 1952. 74p. (UCRL-1689)

A study of inelastic events induced by the bombardment of helium nuclei with 32-Mev protons has been made. No low-energy group of protons has been found which would indicate the existence of an excited state of the helium nucleus which would be stable to decay by particle emission (excitation energy less than ≈ 20 Mev). Considerations on the shape of

the continuum of protons from the reactions $p + \text{He}^4 \rightarrow \text{He}^3 + n + p'$ and $p + \text{He}^4 \rightarrow \text{H}^3 + p'' + p'$ yield a maximum cross section of 0.1 mb/ster. for the detection of a single excited helium level as high as 23.3 Mev above the ground state. Further, the observed extent of the continuum requires the existence of at least two levels of about 1-Mev half width, separated by about 1 Mev. The angular variation of the differential cross section for the production of deuterons from the reaction $p + \text{He}^4 \rightarrow \text{He}^3 + d$ has been measured. When the principle of detailed balancing is invoked, good agreement with the prediction of the theory of S. T. Butler is obtained for r_0 (range of nuclear forces plus radius of He^3 nucleus) = 4.2×10^{-13} cm. (auth)

3408

PHOTODISINTEGRATION BY MESON REABSORPTION.

Robert R. Wilson. Phys. Rev. **86**, 125-6(1952) Apr. 1.

Consideration is given to the process by which high-energy protons are produced by synchrotron bremsstrahlung incident on Nuclei. The theory of Levinger (Phys. Rev. **84**, 43(1951)) explains the angular distribution of the protons, while the proposal (Kikuchi, Phys. Rev. **81**, 1060(1950)) of meson emission and reabsorption explains the large cross section but not the angular distribution. It is pointed out that the discrepancy between the two theories is resolved if the emitted meson is reabsorbed by the system consisting of the parent nucleon and its nearest neighbor. These two nucleons will usually be a neutron and a proton, in which case the meson production and reabsorption will be indistinguishable from the electromagnetic deuteron disintegration process. The system will retain the momentum of the photon, so that the angular distribution will now be given essentially by Levinger's calculation.

3409

NUCLEAR PHOTODISSOCIATION BY HIGH ENERGY SYNCHROTRON GAMMA-RAYS. Seishi Kikuchi. Phys. Rev. **86**, 41-51(1952) Apr. 1. (cf. NSA 5-7266)

The stars and single proton tracks produced in photographic emulsions exposed to a beam of high-energy synchrotron gamma rays have been analyzed. The maximum energy of the bremsstrahlung spectrum was varied between 150 and 300 Mev. The following subjects were studied: 1. the cross section for star production as a function of the excitation energy; 2. the energy distribution of the protons from stars as well as single protons; 3. the angular distribution of star protons as well as single protons; and, 4. the relative number of stars associated with meson coming out. The cross section for the nuclear photoevents increases with increasing energy above the meson threshold. There seem to be two sorts of processes taking place in competition with each other. One is the so called free meson effect; namely, a free meson is produced inside the nucleus by the interaction of a photon with a nucleon and is then absorbed in the same nucleus. The other effect is a process in which a photon is absorbed directly by a group of nuclear particles without emitting a real meson. Evidence for the free meson effect is seen in the fact that the angular distribution of star protons of energy between 20 and 60 Mev in the case of 300-Mev excitation shows a strong forward peak. Evidence for the existence of the direct absorption of photons comes from the fact that the angular distribution of star protons of high energy, say about 100 Mev, shows a forward asymmetry. The cross section for direct absorption is much larger than expected from Levinger's theory of nuclear photodissociation. The cross section should be at least of the same order of magnitude as the free meson effect. (auth)

3410

SPONTANEOUS FISSION RATES. W. J. Whitehouse and W. Galbraith. Nature **169**, 494(1952) Mar. 22.

A graph is presented showing the spontaneous fission rates of several nuclides plotted against the parameter Z^2/A . The spontaneous fission rates of the even-even isotopes lie very nearly upon a straight line with the exception of U^{234} (possibly due to errors in preparation). Plots of odd-odd and odd-even isotopes indicate that they form two separate curves. None of the current theories of fission appear to offer any explanation of the dependence of the spontaneous fission rate upon the number of protons in the nucleus.

PARTICLE ACCELERATORS

3411

Purdue Univ.

SYNCHROTRON PROJECT; PROGRESS REPORT. June 1, 1951. 46p. (AECU-1959)

Successful completion of the assembly of the synchrotron magnet, the vacuum tube, auxiliary controls, and power supplies into a working unit which operated as a betatron and later as a synchrotron is reported. Steps of the assembly are shown photographically.

3412

Iowa State Univ.

PROGRESS REPORT FOR THE PERIOD MARCH 1, 1951 - FEBRUARY 15, 1952, by James A. Jacobs. [nd] 14p. (AECU-1974)

Operational tests are described for the statitron and kevatron. The experiments in progress for the two accelerators are also briefly discussed. No numerical data are presented.

3413

Argonne National Lab.

A NEW SAMPLE MOUNTING MECHANISM AND ASSOCIATED EQUIPMENT FOR USE WITH THE 1.25 MEV VAN DE GRAAFF GENERATOR, by Stewart M. Black. Mar. 1952. 14p. (AECU-1979; UAC-537)

A sample mounting mechanism is described for holding samples during electron irradiation with the 1.2-Mev Van de Graaff accelerator. Details of the apparatus are shown photographically.

3414

PREPARATION OF TRITIUM-ZIRCONIUM TARGETS.

R. S. Rochlin. Rev. Sci. Instruments **23**, 100-1(1952) Feb.

A method of preparing a target, for particle accelerators, of tritium absorbed in zirconium is described. Maximum absorption could be obtained by keeping the zirconium at a certain critical temperature ($\sim 600 \pm 100^\circ\text{C}$) for a few minutes and then allowing to cool to room temperature. The best target made had a ratio of hydrogen isotope atoms to zirconium atoms of 1.0, although 0.8 was a more typical result.

3415

IONS AND ELECTRONS WITH UNIFORM INITIAL VELOCITY IN VACUUM. F. Wenzl. Z. angew. Physik **4**, 94-104(1952) Mar. (In German)

Space-charge equations for electrons and ions of uniform initial velocity in a plane stationary arrangement are integrated. The relation between period and amplitude for periodic potential regions and the question of the appearance of a virtual cathode are investigated.

3416

THE UNIVERSITY OF BIRMINGHAM CYCLOTRON. Nature **169**, 476-7(1952) Mar. 22.

A description is given of the cyclotron at the University of Birmingham in Great Britain. The magnet pole-tip diameter is 61½ in., the air gap is 12 in., the magnet yoke weighs 250 tons, and the copper windings weigh 40 tons. The magnetizing current is 230 amp, producing a field of 18,000 gauss. The operating frequency of the cyclotron is at present 10.24 Mc and the peak voltage between the dees is 150. The cyclotron

is normally used to accelerate the particles D^+ , H_2^{++} , and He^{++} . Particles of 20 Mev are currently available. Experiments in progress include studies of nuclear reactions by bombardment with He^3 , scattering of H^+ and D^+ particles by nuclei, (d,p), (d, α), and (d,t) reactions, and study of short-lived activities.

RADIATION ABSORPTION AND SCATTERING

3417

Oak Ridge National Lab., Y-12 Area

NOTE ON THE DOPPLER EFFECT, by R. R. Coveyou.

Nov. 26, 1951. Decl. Apr. 24, 1952. 4p. (AECD-3350; Y-F10-74)

Calculations are made which show that the effective neutron cross section is not changed by the Doppler effect.

3418

Argonne National Lab.

ABSORPTION SPECTRA OF LANTHANIDE AND ACTINIDE RARE EARTHS; II. TRANSITION PROBABILITIES FOR +3 IONS IN THE TWO SERIES, by D. C. Stewart. Feb. 1952. Decl. Apr. 24, 1952. 28p. (AECD-3351; ANL-WMM-960)

Absorption curves for U^{+3} , Pu^{+3} , and Am^{+3} were determined in perchloric acid, the measurements were also extended into the ultraviolet. Calculated transition probabilities of the electron quantum states for Nd^{+3} , Pm^{+3} , Sm^{+3} , Eu^{+3} , U^{+3} , Np^{+3} , Pu^{+3} , and Am^{+3} are given. In the case of Nd, Sm, Eu, the values found compared favorably with the values reported by Hoogschagen and Gorter (*Physica* 14, 197(1948)). Data relative to the position and magnitude of the chief absorption peaks are also given in some cases.

3419

Armour Research Foundation

MULTIPLE ELASTIC SCATTERING AND RADIATION DAMPING: II, by H. Ekstein. [nd] 33p. (NP-3769)

In Part I of this paper (*Phys. Rev.* 83, 721-9(1951); NSA 5-6479), the multiple scattering problem for finite scattering bodies was restated in terms of a matrix α which describes the scattering of spherically diverging waves by a single scatter, and approximate solutions were derived. In the present Part II, the procedure of restatement in terms of a matrix characterizing a single scattering event is described for infinite periodic media, but the characteristic matrix β differs from α by the omission of radiation damping by elastically scattered particles. The physical cause of this difference is the fact that in an infinite medium particles are not "lost" at infinity. As a consequence, it is found that the imaginary part of $n^2 - 1$ (n refractive index) is proportional to the inelastic cross section rather than to the total cross section as one might expect. Explicit developments for the scalar and classical electromagnetic waves are given. The connection of the matrices α and β with the general theory of scattering is discussed. (auth)

3420

FORWARD SCATTERING OF LIGHT BY A COULOMB FIELD. F. Rohrlich and R. L. Gluckstern. *Phys. Rev.* 86, 1-9(1952) Apr. 1.

The complex scattering amplitude for the scattering of light by a Coulomb field (Delbrück scattering) in the forward direction is calculated exactly by two methods. First, the Feynman method is used and necessitates very tedious and complicated calculations. Then, the method of analytical continuation is applied to the pair-production cross section and yields the same result much more easily. An exact analytical expression is obtained for the dispersive and absorptive parts of the amplitude. The result is plotted as a function of energy. The low energy limit agrees with previous calculations for this limit by Kemmer and Ludwig. (auth)

3421

SMALL ANGLE SCATTERING OF LIGHT BY A COULOMB FIELD. H. A. Bethe and F. Rohrlich. *Phys. Rev.* 86, 10-16(1952) Apr. 1.

The angular distribution for small angles and the total cross section for Delbrück scattering (the elastic scattering of γ rays by the coulomb field of heavy nuclei) are calculated approximately. The method is a combination of an impact parameter and an analytic continuation method. It is valid for energies $\hbar\omega$ large compared to the electron rest energy mc^2 . Curves are given for the shapes of the dispersive and absorptive parts of the differential cross section, valid for angles of order $mc^2/\hbar\omega$ or less. (auth)

3422

NUCLEAR ELASTIC SCATTERING OF HIGH ENERGY PROTONS. R. E. Richardson, W. P. Ball, C. E. Leith, Jr., and B. J. Moyer. *Phys. Rev.* 86, 29-41(1952) Apr. 1.

The differential elastic scattering cross sections of carbon, magnesium, aluminum, silicon, sulfur, copper, silver, tantalum, wolfram, lead, and bismuth for 340-Mev protons are measured as a function of the angle of scattering. The source of the 340-Mev protons is the external scattered deflected proton beam of the Berkeley 184-inch synchrocyclotron. The scattered protons are detected by a triple-coincidence scintillation-counter telescope whose detection threshold is set by copper energy attenuators placed between the last two trans-stilbene scintillators. The observed angular distributions are similar to the pattern observed in Fraunhofer diffraction of plane electromagnetic waves by an opaque disk. The details of the diffraction patterns indicate that the nuclei appear partially transparent to the 340-Mev protons. The observed patterns are found to be consistent with those predicted from elastic scattering of 83-Mev neutrons, indicating that the coulomb forces are only important in changing the patterns at very small angles. An attempt is made to observe spin-dependent variations in the patterns from neighboring nuclei whose moments are known to differ appreciably. Within the statistics and resolution of the experiment no appreciable variations are detected. (auth)

3423

HIGH ENERGY ELECTRON-ELECTRON SCATTERING. Walter H. Barkas, Robert W. Deutsch, F. C. Gilbert, and Charles E. Violet. *Phys. Rev.* 86, 59-63(1952) Apr. 1.

Eradicated electron-sensitive nuclear emulsions were exposed to 200-Mev electrons at the Berkeley synchrotron. In scanning the electron tracks 427 events were observed in which the scattered electron of lower energy, or knock-on electron, had an energy greater than 30 kev. The observed differential cross section was found to agree in absolute value with Møller's theoretical cross section, although an insufficient number of high-energy knock-on electrons were observed to distinguish between the Møller, relativistic Mott, and relativistic Rutherford formulas. Two pairs initiated by primary electrons and two cases in which primary electrons vanished in the emulsion were also observed in 102.6 cm of track. No heavy-particle events were seen. (auth)

3424

FAST PROTONS FROM 270-MEV n-d COLLISIONS. J. B. Cladis, J. Hadley, and W. N. Hess. *Phys. Rev.* 86, 110-17(1952) Apr. 1.

The differential cross section for production of high-energy protons in n-d scattering, using the 270-Mev neutron beam of the 184-in. cyclotron, has been measured at scattering angles between 4° and 58° . For normalization, yields of protons from n-p scattering were measured at each scattering angle. In all cases, only protons above a cut-off energy of 200 Mev $\cos^2\theta$ were accepted by the counter system. In addition, through the use of a magnetic analyzer,

energy distributions of the n-d protons were measured at 4° and 22.5° . The energy distributions closely resembled, in shape, the energy distributions of n-p protons at the same angles, confirming the similarity in nature between collisions of high-energy neutrons with free protons and collisions with protons bound in deuterium. Total yield of protons above the cut-off energy is lower for n-d than for n-p collisions, however, the ratio of the two being about 0.7 at all angles observed. Effects of the exclusion principle, of the internal momentum distribution of the deuteron, and of the difference in average potential energy between the dineutron and the deuteron are discussed as possible causes of the lowering of the n-d proton yield below that from n-p scattering. (auth)

3425

THE INELASTIC SCATTERING OF FAST NEUTRONS FROM IRON. P. H. Stelson and W. M. Preston. *Phys. Rev.* **86**, 132-3(1952) Apr. 1.

Neutrons of energy between 1.82 and 1.92 Mev, produced by 3.61-Mev proton bombardment of Li, were scattered by a small Fe cylinder. Scattered neutrons were detected by the tracks of recoil protons in nuclear emulsions placed at 90° to the beam. Histograms are shown of relative neutron intensity vs. neutron energy for the direct beam, the scattered beam, and the background with scatterer removed. In the scattered beam 3 groups appear, 2 due to elastic scattering of the primary and secondary neutron groups from the Li(p,n) reaction and the third due to excitation of a level at 850 ± 50 kev by inelastic neutron scattering. Consideration of track densities and exposure times gives $d\sigma_{\text{elastic}}/d\Omega = 0.112 \pm 0.023$ and $d\sigma_{\text{inelastic}}/d\Omega = 0.062 \pm 0.015$ barn/steradian at 90° (lab). Assumption of isotropic scattering gives 1.40 and 0.82 barns for σ_e and σ_{in} .

3426

CAPTURE CROSS SECTIONS OF SEVERAL ELEMENTS FOR SLOW NEUTRONS BY THE PILE-OSCILLATION METHOD. J. Ailloud, D. Breton, A. Ertaud, and V. Raievski. *J. phys. radium* **13**, 171(1952) Mar. (In French)

The following capture cross sections in barns were determined by the local pile-oscillation method of Hoover et al., (*Phys. Rev.* **74**, 864(1948)): Li, 66.8 ± 3.4 ; Co, 35.4 ± 1 ; Ge, 2.23 ± 0.2 ; Nd, 43.2 ± 1 ; Hg, 354 (resonances).

3427

ON POLARIZATION OF GAMMA QUANTA BY COMPTON SCATTERING AT 180° . Ya. B. Zel'dovich. *Doklady Akad. Nauk S.S.S.R.* **83**, 63-6(1952) Mar. 1. (In Russian)

Polarization of photons of various energies scattered from free electrons is discussed theoretically.

3428

SCATTERING OF 200-MEV NUCLEONS BY α PARTICLES. Jean Heidmann. *Compt. rend.* **234**, 1446-8(1952) Mar. 31. (In French)

By the same method used for 90-Mev nucleons (Heidmann, *Phil. Mag.* (7) **41**, 444(1950)), the differential cross section for elastic scattering of 200-Mev nucleons by α particles is calculated to be $d\sigma/d\Omega = 4.50 \exp(-17.5 \theta^2) \times 10^{-25} \text{ cm}^2$, indicating that the nucleon is scattered forward with a total cross section of 81 mb and a semi-half-width of 11° . The differential cross section for inelastic scattering with stripping of a nucleon is plotted for various energies of the emitted triton as a function of the triton recoil angle. Graphical integration gives a total cross section of 90 ± 20 mb. For scattering with deuteron formation, the calculation gives a result two orders of magnitude too small. Inaccuracies in the theory are discussed.

3429

NEW REMARK ON COLLISIONS BETWEEN ATOMS AND ELECTRONS. S. Kichenassamy. *Compt. rend.* **234**, 1530-2(1952) Apr. 7. (In French)

Equations for the probability amplitudes of the initial, intermediate, and final states of scattered electrons are derived by a theory previously projected by the author (*Compt. rend.* **234**, 1035(1952); NSA 6-2765). The method used in a paper on the interaction between matter and radiation (*J. phys. radium* **12**, 863(1951); NSA 6-1361) is justified.

3430

ABSORPTION OF 2-MEV CONSTANT POTENTIAL ROENTGEN RAYS BY LEAD AND CONCRETE. W. W. Evans, R. C. Granke, K. A. Wright, and J. G. Trump. *Radiology* **58**, 560-7(1952) Apr.

Graphs are presented of the absorption of 2-Mev x rays by Pb and concrete. It is shown that after the first two half-value thicknesses, the x-ray intensity diminishes exponentially with increased absorber thickness. Measurements are also reported for Cu and Al. The initial half-value layer thicknesses are 7.3 mm, 12.5 mm, and 38.5 mm in Pb, Cu, and Al respectively. Tabulated results for γ rays from Ra and Co⁶⁰ are also presented for comparison purposes.

3431

THE THEORY OF IONIZATION AND THE EMISSION OF CERENKOV RADIATION. M. Schönberg. *Nuovo cimento* (9) **9**, 210-11(1952) Feb. 1. (In English)

Experimental results on the absorption of Cherenkov radiation suggest that the present form of the theory of ionization loss by relativistic charged particles is not satisfactory, there being less Cherenkov radiation and more direct ionization and excitation.

3432

ON POLARIZED PARTICLE BEAMS. R. H. Dalitz. *Proc. Phys. Soc. (London)* **65A**, 175-8(1952) Mar. 1.

A partially polarized beam of particles is represented by a statistical operator in spin space. For nucleon-nucleon scattering a theorem stated by Wolfenstein (*Phys. Rev.* **75**, 1664(1949); **76**, 541(1949)) connecting the two simplest experiments involving polarized nucleons is shown to depend on the invariance of the interaction potential under time-reflection. (auth)

RADIATION EFFECTS

3433

Massachusetts Inst. of Tech.

X-RAY STUDY OF RADIATION DAMAGE, by B. E. Warren. *Dec. 31, 1951. 5p. (NYO-767)*

Brief statements describe the work done prior to January 1, 1952 on the x-ray study of radiation damage. The experiments summarized are entitled: developments in experimental techniques for the x-ray study of damage, development of a generalized Fourier technique for the analysis of x-ray patterns of damaged materials, development of x-ray studies of cold work distortion in metals, development of x-ray diffraction studies of irradiated samples, and development of technique for sample preparation.

RADIOACTIVITY

3434

Brookhaven National Lab.

THE DECAY SCHEME AND ANGULAR CORRELATION OF Pr^{144} , by D. E. Alburger and J. J. Kraushaar. [nd] 16p. (BNL-1154)

The decay scheme and angular correlation of Pr^{144} have been studied with lens-spectrometer and scintillation-counter techniques. The beta-ray spectrum shows three groups with end-points at 2.965 ± 0.015 , 2.3 ± 0.1 , and 0.86 ± 0.1 Mev, the first having a relative intensity of 90 percent, the others each about 5 percent. Gamma-rays were observed in photoelectric conversion and have energies of 0.695 ± 0.005

1.48 ± 0.01 , and 2.185 ± 0.015 Mev and relative intensities of 1:0.4:1.1, respectively. The data indicate that beta-emission takes place to states in Nd^{144} at zero, 0.695, and 2.185 Mev. The absorption of beta rays in coincidence with gamma rays shows two components with ranges of 0.34 and 1.0 g/cm² aluminum. The corresponding energies and intensities of these beta groups confirm the above decay scheme. Gamma-gamma coincidences are also present and their angular correlation has the form $1 - 0.33 \cos^2\theta$, characteristic of either a 1-2-0 or a 1-1-0 cascade. It is suggested that the first excited state of Nd^{144} has spin 2 and even parity and the second level spin 1. Some of the features of Ce^{144} decay are described and the usefulness of this fission-product isotope as a source of homogeneous photoneutrons is discussed. (auth)

3435

Brookhaven National Lab.

INTERNAL CONVERSION OF GAMMA-RAY TRANSITIONS IN THE L SUB-SHELLS, by J. W. Mihelich. [nd] 22p. (BNL-1155)

A number of internally converted γ transitions have been investigated with high-resolution β spectrographs and the relative intensities of conversion electron lines from the three L sub-shells obtained. Generalizations are made for L conversion as related to multipole order. The magnetic transitions investigated are converted in the L_I and L_{III} shells, the ratio L_{III}/L_I increasing with increasing multipole order. Less can be said about electric transitions; but L conversion takes place mainly in the L_{II} and L_{III} shells for the transitions studied. (auth)

3436

Princeton Univ.

THE BETA SPECTRUM OF Cl^{36} , by H. W. Fulbright and J. C. D. Milton. Feb. 14, 1951. 7p. (NYO-782)

This material appeared in *Phys. Rev.* 82, 274(1951) and was abstracted in *Nuclear Science Abstracts* as NSA 5-6449.

3437

Rochester Univ.

A REDUCTION OF ARBITRARINESS IN THE THEORY OF FORBIDDEN β -SPECTRA, by C. L. Longmire and A. M. L. Messiah. May 1951. 5p. (NYO-790)

This report was issued as AECU-1450 and abstracted in *Nuclear Science Abstracts* as NSA 5-5427.

3438

FIRST-FORBIDDEN BETA-DECAY MATRIX ELEMENTS.

T. Ahrens and E. Feenberg. *Phys. Rev.* 86, 64-8(1952) Apr. 1.

The general theory of first-forbidden beta transitions involves seven nuclear matrix elements in the nonrelativistic approximation. In principle the number of independent parameters can be reduced to four with the help of the relation

$$(W_s - W_i)(f|X|i) = (f|[H_0, X]|i) + (f|[H_c, X]|i) + (f|[H_v, X]|i).$$

Here W is an energy eigenvalue, X a coordinate type first-forbidden operator, H_0 the free particle hamiltonian, H_c the coulomb interaction, and H_v the specifically nuclear interaction. The commutators of H_0 and H_c with X are easily evaluated, but $[H_v, X]$ presents difficulties. However, the matrix elements of $[H_v, X]$ can be estimated by general physical arguments based on the semi-empirical energy surface and the validity of shell model considerations. The explicit form of H_v is not required, a fortunate circumstance since H_v for complex nuclei is at present essentially unknown. These calculations determine the common proportionality factor Λ in the relations

$$\frac{1}{2}\Lambda\alpha Z \int r/R = -i \int \alpha,$$

$$\frac{1}{2}\Lambda\alpha Z \int \sigma \cdot r/R = -i \int \gamma,$$

$$\frac{1}{2}\Lambda\alpha Z \int \sigma \times r/R = - \int \beta\alpha. \text{ (auth)}$$

3439

THE AVERAGE ENERGY OF BETA-RAY SPECTRA.

Randall S. Caswell. *Phys. Rev.* 86, 82-5(1952) Apr. 1.

The average beta energy per disintegration has been measured for P^{32} , Y^{90} , I^{131} , and Ca^{45} . An air-filled water-electrode extrapolation ionization chamber was used for measurement of the rate of emission of energy. The absolute disintegration rate was determined by 4π -counting. Good agreement was found between the measured average energy values and values predicted by the Fermi theory using maximum-energy data from the literature. Experimental results obtained were P^{32} , 0.696 ± 0.03 Mev; Y^{90} , 0.895 ± 0.035 Mev; I^{131} , 0.189 ± 0.008 Mev (includes conversion electrons); and Ca^{45} , 0.0746 ± 0.003 Mev. (auth)

3440

THE NUCLEAR SPECTRUM OF Ge^{77} . Alan B. Smith.

Phys. Rev. 86, 98-101(1952) Apr. 1.

The disintegration of Ge^{77} (12 hour) has been studied with the help of a magnetic lens spectrometer, coincidence counters, and scintillation counters. The beta-ray spectrum consists of three groups whose endpoint energies are 2.196, 1.379, and 0.710 Mev. In addition there are 13 gamma rays appearing in the product nucleus As^{77} , some of which are internally converted. By coincidence-counting techniques it has been shown that the beta ray of energy 2.196 Mev does not go to the ground state but to an excited state 0.264 Mev above the ground state. A disintegration scheme is suggested. (auth)

3441

RESEARCH ON THE β SPECTRUM OF RaD BY THE METHOD OF β PARTICLE-CONVERSION ELECTRON COINCIDENCES. Jean Teillac, Paul Falk-Vairant, and Charles Victor. *J. phys. radium* 13, 143-7(1952) Mar. (In French)

The radiation emitted by RaD (Pb^{210}) in coincidence with the conversion electrons corresponding to the 47-kev excited state of RaE (Bi^{210}) have been studied. The different absorption curves suggest that the radiation is probably composed of Auger electrons produced by rearrangement of the L shell. For each 100 RaD disintegrations, 100 ± 10 electrons, consisting of 74 conversion electrons and the corresponding Auger electrons, were found. No electrons were attributable to the continuous β spectrum. It is deduced that the largest part of this spectrum ($\geq 90\%$) has an energy below 5 kev.

3442

INVESTIGATION OF X AND γ RAYS EMITTED BY Pa^{231} .

Michel Riou. *Compt. rend.* 234, 1157-9(1952) Mar. 10. (In French)

Absorption curves in Cu and Pb showed four components of 300-, 100-, 27-, and 15-kev energy with respective intensities of 4 ± 1 , 2.5 ± 0.5 , 9 ± 2 , and 36 ± 5 photons per 100 disintegrations. Absorption in various elements showed the 100-kev component to be composed of two groups with energies 100 ± 10 and 87.0 ± 1.2 kev and an intensity ratio of 2.5 ± 0.8 , the 27-kev line to be unique at 27.3 ± 0.6 kev, and the 15-kev component to consist of 14.45 ± 1.75 - and 12.27 ± 0.42 -kev lines with intensity ratio 1.2 ± 0.4 . Each of these components must be complex. Their origins in γ transitions and internal conversion are discussed.

3443

ON THE EXISTENCE OF ARTIFICIAL RADIOACTIVE PRODUCTS IN RAIN WATER IN THE REGION OF PARIS. Marcel Abribat, Robert Pinoir, Jacques Pouradier, and Anne-Marie Venet. *Compt. rend.* 234, 1161-3(1952) Mar. 10. (In French)

Notable increases in β activity in Paris rain water were found 8 to 15 days following each of the Nevada atomic bomb explosions, Oct. 22, Nov. 5, and Nov. 19, 1951. The activity consisted of a mixture of β emitters with periods of a few days to several months. Activity during the month of January

1952, was low but above normal, suggesting a long period of atmospheric contamination.

3444

A DETERMINATION OF THE RATE OF EMISSION OF SPONTANEOUS FISSION NEUTRONS BY NATURAL URANIUM. D. J. Littler. *Proc. Phys. Soc. (London)* **65A**, 203-8(1952) Mar. 1.

By comparison with a calibrated neutron source, the total rate of emission of primary neutrons in the Graphite Low Energy Experimental Pile (Gleep), Harwell, has been found. The rate of emission of spontaneous fission neutrons from natural U is computed to be 59.5 ± 3.3 neutrons/g/hr. (auth)

SHIELDING

3445

Oak Ridge National Lab.

CONSTRUCTION OF CHEAP SHIELD: A SURVEY, by Theodore Rockwell, III. Jan. 16, 1950. Decl. with deletions Apr. 25, 1952. 33p. (AECD-3352; ORNL-243)

A survey of shielding a radiation source at minimum cost is presented. Concrete and metal shields are discussed. Factors which influence the cost of high-density concrete shields are evaluated. Mixing and handling techniques for concrete are recommended, and various aggregate materials are suggested. Various metal shields are suggested. The advantages and disadvantages of these shields are enumerated. Non "thermal shields" have questionable value; "Boral" is expensive, and "Boroxal" is cheap but not as good as "Boral." A number of tables are included in this report showing the properties of the various "cheap shields," "cheap" aggregate, and boron vehicles. Cost data are supplied where available. (auth)

3446

A CLOSE SHIELD FOR USE IN MICROPIPETTING RADIO-ISOTOPE STOCK SOLUTIONS. N. J. Holter and W. R. Glasscock. *Rev. Sci. Instruments* **23**, 138(1952) Mar.

A shield has been designed which introduces at least a one-hundredth value layer of absorber between the source and operator while transfer is being made in the micropipetting of isotopes. An isotope bottle is transferred to the shield, the cap unscrewed with a rubber stopper attached to the end of a steel pole, and the bottle rotated until the fluid is visible through a lucite port. The top is then put on and the pipetting carried out.

SPECTROSCOPY

3447

Columbia Univ.

MAGNETIC HYPERFINE STRUCTURE IN THE O_2 MOLECULE, by S. L. Miller, M. Kotani and C. H. Townes. Mar. 5, 1952. 2p. (NYO-987)

Magnetic hyperfine structure has been observed in the microwave spectrum of $O^{16}O^{17}$ in the 5-mm region. The components of the fine structure transitions which fall between 59,250 and 60,300 Mc have been identified and are in agreement with the theory of R. A. Frosch (Dissertation, Columbia Univ. Dec., 1951) which predicts a perturbation hamiltonian $bI \cdot S + CI_2 S_z$ for the $^3\Sigma$ state. Both b and c contain terms belonging to the dipole-dipole and the relativistic interactions between the magnetic moments of the O^{17} nucleus and the unpaired electron spins. Values of $b = -101$ Mc and $c = 140$ Mc fit the observed spectrum well, incidentally corroborating the reported value of $\frac{1}{2}$ for the O^{17} spin. These values determine the sign and magnitude of the dipole-dipole interaction and show that the unpaired electrons are primarily in $2p\pi$ orbits. The value of $\psi^2(0)$ obtained further shows that they have approximately 1% 2s character. The data are consistent with unpaired electron wave func-

tions that are about 90% $2p\pi$ and 10% $2p\sigma$ in character, where the $2p\sigma$ orbit is 10% 2s hybridized. (Entire report)

3448

INTERFEROMETRIC MEASUREMENTS OF THE HYPERFINE STRUCTURE OF THE MERCURY GREEN LINE.

John Sterner. *Phys. Rev.* **86**, 139-40(1952) Apr. 1.

A novel Fabry-Perot interferometer which permits photographing of patterns rapidly and with high resolution has been used to measure the hyperfine structure of the Hg green line. Each interferometer plate consists of a Multilayer film formed by the alternate deposition of layers of two dissimilar dielectrics. A typical interferogram is shown. Results, in units of 10^{-3} cm^{-1} are as follows: Hg^{201} -86.9; Hg^{198} -56.6; Hg^{200} -32.6; Hg^{199} 0.4; Hg^{202} 0; and Hg^{204} 29.8. Staggering values calculated for Hg^{199} and Hg^{200} are in good agreement with those of Schüler (*Z. Physik* **72**, 423(1931)) for 2537A.

3449

ENERGY LEVELS OF HEAVY ATOMS. Y. Cauchois. *J. phys. radium* **13**, 113-21(1952) Mar. (In French)

Atomic energy levels in electron volts of the elements from ^{70}Yb to ^{92}U , calculated from x-ray spectra, are tabulated. Frequencies of the "discontinuity" of the L_{III} absorption and the K and L emissions are listed. The precision and significance of the data, the mechanism of photoelectric absorption of x rays, and the origin of absorption discontinuities are discussed.

THEORETICAL PHYSICS

3450

ON CERTAIN FUNCTIONAL TRANSFORMATIONS OF THE EVOLUTION EQUATION. Antoine Visconti. *Comp. rend.* **234**, 817-19(1952) Feb. 18. (In French)

The evolution equation for the case of collisions, function associated with the Stueckelberg-Feynman positron, certain unitary and Fourier transformations of the evolution equation, a perturbation solution, and application to a second-order equation are discussed.

3451

ON THE RELATIONS BETWEEN THE COEFFICIENTS OF CHARGE AND MASS IN THE THEORY OF THE SUBTRACTIVE FIELD. Louis de Broglie. *Compt. rend.* **234**, 1505-7(1952) Apr. 7. (In French)

An equation relating the charge and mass coefficients in the interaction of a point electron with a number of meson or electromagnetic fields is derived in subtractive field theory.

3452

ON THE REPRESENTATION OF WAVE EQUATIONS OF PARTICLES OF SPIN 0 OR \hbar . Gérard Petiau. *Compt. rend.* **234**, 1534-7(1952) Apr. 7. (In French)

Two operators are introduced by which the matrices occurring in L. de Broglie's theory of the photon (Une Nouvelle Théorie de la Lumière, Paris, Hermann, 1940) can be applied to the irreducible representation of spin- \hbar particles (Maxwell photons or vector mesons) or spin-0 particles (non-Maxwell photons or pseudoscalar mesons).

3453

ON THE EVALUATION OF THE MEAN WITH RESPECT TO POLARIZATION STATES IN PROCESSES PERMITTING THE EMISSION OR ABSORPTION OF SPIN- \hbar PARTICLES. APPLICATION TO ELECTROMAGNETIC, MESON, AND PHOTOMESON COMPTON EFFECTS. Gérard Petiau. *J. phys. radium* **13**, 134-42(1952) Mar. (In French)

A formula given by Feynman (*Phys. Rev.* **76**, 780(1949)) for the evaluation of the mean with respect to polarization states in processes permitting emission or absorption of real spin-1 quanta of vector type is extended and applied to calculation of scattering cross sections for electromag-

netic or generalized meson, photomeson, and mesophoton Compton effects.

- 3454
COUPLING OF ELECTRON AND NUCLEAR MOTIONS IN MOLECULES AND CRYSTALS. M. Born. *Nachr. Akad. Wiss. Göttingen Math.-physik. Klasse IIa Abt.*, No. 6(1951). 3p. (In German)

An expression describing the motion of the nucleus under the action of an electron-state potential is derived. Certain limitations of the method of Born and Oppenheimer (*Ann. Physik* 84, 457(1927)) are avoided.

- 3455
EXCITED STATES OF A PARTICLE IN A FIELD. S. V. Tyablikov. *Doklady Akad. Nauk S.S.S.R.* 81, 31-3(1951). (In Russian)

Expressions are derived for the effective masses and effective moments of the excited states of a particle interacting with a scalar field, the coupling being adiabatic. (cf. NSA 5-4923)

- 3456
ON A CLASS OF FUNDAMENTAL EQUATIONS OF THE RELATIVISTIC QUANTUM THEORY OF FIELDS. N. N. Bogolyubov. *Doklady Akad. Nauk S.S.S.R.* 81, 1015-18 (1952). (In Russian)

PATENTS

CHEMISTRY

- 3457
METHODS OF MAKING NEPTUNIUM CHLORIDES. S. Fried and N. R. Davidson (to U. S. Atomic Energy Commission). U. S. Patent No. 2,578,416, Dec. 11, 1951.
This process for the preparation of neptunium trichloride from neptunium dioxide, comprises reacting the latter compound with a chlorine-containing compound of carbon such as carbon tetrachloride in the presence of hydrogen at a temperature between 300 and 530°C.

- 3458
HALOGEN-SUBSTITUTED ACETYL PEROXIDE CATALYST FOR HALO-OLEFIN POLYMERIZATION. W. T. Miller, A. L. Dittman, and S. K. Reed (to U. S. Atomic Energy Commission). U. S. Patent No. 2,586,550.
This method for preparing a solid high-molecular-weight polymer of trifluorochloroethylene comprises treating the monomer with a small amount of trichloroacetyl peroxide at a temperature in the range -20 to 0°C and at a pressure of at least 500 psi.

- 3459
THE SEPARATION OF METAL VALUES IN FLUORIDE COMPOSITIONS. M. A. Perkins and M. Couper (to U. S. Atomic Energy Commission). U. S. Patent No. 2,588,041, Mar. 4, 1952.
A method is described for recovering the valuable components of a solid sludge which contains K, Ni, Fe, and F values and which is obtained in the electrolysis of potassium acid fluoride to produce F. The solid sludge is treated with sufficient ammonium hydroxide to dissolve the Ni and K and precipitate the Fe. The solution containing Ni, K, ammonium and fluoride values may be suitably treated to recover nickel fluoride, potassium fluoride and ammonium fluoride.

- 3460
METHOD OF MAKING METAL HYDRIDE. A. S. Newton (to U. S. Atomic Energy Commission). U. S. Patent No. 2,588,153, Mar. 4, 1952.

This process for making the hydride of a heavy metal, such as uranium, of high bulk compressibility, comprises

subjecting the heavy metal at a temperature of 500 to 700°C to the action of hydrogen under a pressure of more than 1000 psi and compressing the crystalline hydride at a pressure in the range of 75 to 175 tons/in².

- 3461
PRETREATMENT OF BERYLLIUM PRIOR TO COATING. M. Kolodney (to U. S. Atomic Energy Commission). U. S. Patent No. 2,588,734, Mar. 11, 1952.

A method is described for preparing the surface of Be metal for subsequent covering with a smooth uniformly adherent metal coating. The surface is prepared by an anodic etch of the Be object immersed in an electrolyte comprising a mixture of a strong polybasic oxygen-containing inorganic acid and a strong monobasic oxygen-free acid, e.g., a mixture of phosphoric acid and hydrochloric acid. The etched surface may be further improved by briefly immersing the Be in a solution containing sulfate ions, such as an aqueous ammonium sulfate solution.

- 3462
BORON CHLORIDE PRODUCTION FROM AN ALLOY OF BORON WITH TANTALUM. C. A. Hutchison, Jr., and J. S. Smith (to U. S. Atomic Energy Commission). U. S. Patent No. 2,589,391, Mar. 18, 1952.

In a method of recovering B from an alloy of B and Ta, the alloy is treated with a stream of Cl gas at a temperature between 575 and 900°C. Tantalum chloride is continuously condensed from the gaseous reaction products and the resulting gas stream of Cl and boron chloride is treated to recover the boron chloride.

- 3463
PROCESSES FOR PHOTOCHEMICAL CHLORINATION OF HYDROCARBONS. A. Loverde (to U. S. Atomic Energy Commission). U. S. Patent No. 2,590,426, Mar. 25, 1952.

A process is described for photochemical chlorination of heptane to approximately 80% Cl. The chlorination of the heptane is accomplished in the presence of actinic light by contacting with Cl which is diluted with approximately equal volume of inert gas for a first period of about 48 hours at a temperature gradually rising from 25 to 50°C, then contacting with undiluted Cl for a further period of about 80-hr at a temperature gradually rising to approximately 150°C.

- 3464
PROPORTIONAL COUNTER. C. J. Borkowski and E. Fairstein (to U. S. Atomic Energy Commission). U. S. Patent No. 2,590,925, Apr. 1, 1952.

This proportional counter system comprises a counter tube employing a polyatomic filling gas, a suitable amplifying system which provides for pulse amplification and overshoot reduction, and having as a characteristic of its operation a relatively long voltage plateau of less than 1% rise in counting rate.

ENGINEERING

- 3465
APPARATUS FOR GOVERNING FLUID FLOW. A. O. C. Nier, R. B. Thorness, and C. M. Stevens (to U. S. Atomic Energy Commission). U. S. Patent Application No. 2,586,984, Feb. 26, 1952.

This non-fractionating capillary leak comprises a length of metal tubing, a cylindrical element positioned therein to provide an annular fluid-conducting passage of reduced cross section in the tubing, and adjustable gripping means for controlling the cross-sectional area of the passage.

MINERALOGY, METALLURGY, AND CERAMICS

- 3466
CASTING APPARATUS. C. F. Gray (to U. S. Atomic Energy Commission). U. S. Patent No. 2,586,027, Feb. 19, 1952.

In a casting apparatus for the centrifugal casting of metals in vacuo, provision is made for balancing the rotor before actuation.

PHYSICS

3467

ADJUSTABLE SUPPORTS FOR SPECTROMETER REFLECTORS. L. B. Borst and R. J. Fox (to U. S. Atomic Energy Commission). U. S. Patent No. 2,579,225, Dec. 18, 1951.

In a mounting arrangement for a reflector for use in a spectrometer, manual means are provided for adjusting the radius of curvature of a reflector and for adjusting its lateral and angular position about a horizontal axis.

3468

PULSE FORMING NETWORK. W. R. Aiken (to U. S. Atomic Energy Commission). U. S. Patent No. 2,587,426, Feb. 26, 1952.

A pulse-forming control network is described which is responsive to a predetermined frequency of a f-m signal voltage to form a pulse at the predetermined frequency according to the direction of frequency shift, and is independent of amplitude modulation and extraneous interference.

3469

ELECTRICAL APPARATUS FOR SIMULATING THE TIME DEPENDENT RESPONSE FOR CHARACTERISTIC OF NEUTRONIC REACTORS. H. A. Straus, P. R. Bell, Jr., and F. H. Murray (to U. S. Atomic Energy Commission). U. S. Patent No. 2,587,919, Mar. 4, 1952.

This instrument, adapted to simulate the time-dependent response characteristic of a neutronic reactor, is so designed that an electric parameter, such as voltage, varies with time in exactly the same manner as does the neutron density of a reactor. The device has many uses in connection with the design and operation of a nuclear reactor.

3470

ELECTRICAL GENERATOR. A. H. Barnes (to U. S. Atomic Energy Commission). U. S. Patent No. 2,588,466, Mar. 11, 1952.

This improved high-current homopolar generator employs a liquid-metal brush comprising an alloy of sodium and potassium.

3471

THERMOELECTRICALLY BALANCED METER NETWORK. G. S. Pawlicki (to U. S. Atomic Energy Commission). U. S. Patent No. 2,588,564, Mar. 11, 1952.

An electrical resistance network is so arranged as to overcome the adverse effects of thermoelectric currents resulting from the juncture of different metals and changes in the ambient temperature of the system and of the connections therein.

3472

NEUTRON DETECTOR. W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent No. 2,588,789, Mar. 11, 1952.

A neutron-responsive device, comprising essentially a glass vessel of tubular shape the inner surface of which is coated with a material which emits α particles when irradiated with neutrons. The vessel contains an ionizable gas and a pair of spaced apart discharge electrodes. The two electrodes have rounded and pointed ends, respectively.

3473

HALF-LIFE DETERMINING METHOD. C. E. Wiegand (to U. S. Atomic Energy Commission). U. S. Patent No. 2,590,057, Mar. 18, 1952.

A counting method and apparatus are described for determining the rate of change of non-linear physical phenomena by measuring the number of pulses emitted by a radioactive decaying sample within each of a plurality of known time intervals.

3474

OSCILLATOR CONTROLLED RELAY CIRCUITS. R. T. Schenck (to U. S. Atomic Energy Commission). U. S. Patent No. 2,590,826, Mar. 25, 1952.

Accurate liquid-level or liquid-density control of reacting liquids is obtained without mechanical or electrical contact between the control apparatus and the material whose level or density is being controlled. The system includes a tuned oscillator and associated circuit with an amplifier system so arranged that the oscillator is at all times under the control of a float in the liquid.

3475

COINCIDENCE AMPLIFIERS. H. D. Farnsworth (to U. S. Atomic Energy Commission). U. S. Patent No. 2,591,247, Apr. 1, 1952.

A coincidence amplifier circuit is described for determining the quantity of high speed particles traveling in a predetermined direction. The output signals of this multi-channel amplifier are applied to a mixer in such a manner that a signal has to appear simultaneously at the output of each channel before a signal will appear at the output of the mixer.

3476

LEAK DETECTOR. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent No. 2,591,998, Apr. 8, 1952.

This gas-leak detector of the mass spectrometer type involves an electric circuit for periodically directing ions corresponding to the indicator gas onto the ion receiver and for amplifying the resulting periodic current, thereby providing a leak detector of great sensitivity.

3477

INDICATING DEVICES FOR RADIOACTIVITY INTENSITY. E. J. Groth, Jr. (to U. S. Atomic Energy Commission). U. S. Patent No. 2,592,416, Apr. 8, 1952.

This counting rate meter circuit, which will deliver pulses of uniform magnitude, has an impedance load including a choke to provide a back emf which is substantially independent of input-pulse size and furnishes an indication proportional to the pulse rate.

3478

DISTRIBUTED COINCIDENCE CIRCUIT. C. E. Wiegand and O. Chamberlain (to U. S. Atomic Energy Commission). U. S. Patent No. 2,593,948, Apr. 22, 1952.

This wide-band circuit for detecting pulses of varying amplitude, based on the principle of distributed amplification, has a resolving time of the order of 10^{-8} sec. The necessary balancing of the interelectrode capacitances for the two circuits is accomplished by providing staggered connections between the related grid of the tubes and the grid lines.

3479

SURVEY INSTRUMENT. C. J. Borkowski (to U. S. Atomic Energy Commission). U. S. Patent Application No. 748,433.

This pulse-type survey instrument is suitable for readily detecting α particles in the presence of high β and γ backgrounds. The instrument may also be used to survey for neutrons, β particles and γ rays by employing suitably designed interchangeable probes and selecting an operating potential to correspond to the particular probe.

3480

ELECTRONIC GRID AND METHOD OF MAKING SAME. W. E. Glenn and E. W. Hostetter (to U. S. Atomic Energy Commission). U. S. Patent Application No. 249,374.

The described method is particularly adapted to making a grid having parallel wires in which parallelism will be maintained under use, such as in a klystron or the like.

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Numerical Index of Official Atomic Energy Reports with Indications of Their Availability

This list in the individual issues of Volume 6 supplements the Numerical Index of Reports with Indications of Their Availability which appears in NSA, Volume 5, No. 24. As reports are in manuscript form when abstracted for NSA, there may be some delay before the reports will be available at the Depository Libraries. The notation NSA in the Availability column indicates the appearance of a report in its entirety in NSA.

Abbreviations used below are:

- NSA - NUCLEAR SCIENCE ABSTRACTS
- ADD - ABSTRACTS OF DECLASSIFIED DOCUMENTS
the predecessor of NSA
- NNES - National Nuclear Energy Series, published by
the McGraw-Hill Book Company

Code designations are assigned as follows:

- MDDC - To declassified reports released by the Man-
hattan Engineer District and by the Atomic
Energy Commission before March 1, 1948

AECD - To declassified reports released by the Atomic
Energy Commission after February 29, 1948
(appeared in April 15, Nuclear Science Ab-
stracts)

AECU - To unclassified reports originating within the
Atomic Energy Project. (Subsequent to AECU-
871, this code is applied only to reports carry-
ing no other recognized code designation.)

Other code designations below are assigned to unclassified
reports by the originating installations

| Report | Abstract | Availability | Report | Abstract | Availability |
|-----------|-----------|--|-----------|------------|------------------------------------|
| AECD-2997 | NSA 5-388 | Dissertation, Iowa State College, 1951 | ISC-152 | NSA 6-2012 | \$0.25 |
| 3149 | 5-4035 | Phys. Rev. 86, 21-8(1952) | 166 | 5-7052 | J. Am. Chem. Soc. 74, 2052-4(1952) |
| 3173 | 5-5164 | J. Metals 4, 397-400(1952) | 189 | 6-1531 | \$0.15 |
| 3226 | 5-5168 | J. Electrochem. Soc. 99, 197-204(1952) | 192 | 6-1992 | \$0.20 |
| AECU-1374 | 5-4706 | J. Am. Chem. Soc. 74, 2055-8(1952) | NYO-564 | 5-8725 | \$0.20 |
| 1438 | 5-4954 | Brit. J. Radiology, 25, 182-9(1952) | 706 | 5-3700 | Phys. Rev. 81, 628-9(1951) |
| 1518 | 5-4707 | J. Am. Chem. Soc. 74, 1968-9(1952) | 707 | 5-3745 | Phys. Rev. 81, 484-5(1951) |
| 1558 | 5-5067 | Anal. Chim. Acta 6, 363-7(1952) | 884 | 5-4531 | Phys. Rev. 82, 268-9(1951) |
| 1607 | 5-5907 | Rev. Sci. Instruments 23, 97(1952) | 886 | 5-5865 | Phys. Rev. 82, 454-5(1951) |
| 1688 | 6-148 | J. Am. Chem. Soc. 74, 2090-4(1952) | UCRL-1590 | 6-1863 | \$0.25 |
| 1822 | 6-1287 | \$0.05 | 1599 | 6-918 | Phys. Rev. 86, 123(1952) |
| 1856 | 6-1676 | Science 115, 406(1952) | 1609 | 6-2057 | \$0.15 |
| BMI-713 | 6-915 | \$0.10 | 1634 | 6-2162 | \$0.30 |
| BNL-1109 | 6-2390 | Phys. Rev. 86, 128-9(1952) | 1665 | 6-2483 | Phys. Rev. 86, 126-7(1952) |
| | | | 1677 | 6-2415 | \$0.10 |
| | | | 1695 | 6-2674 | \$0.10 |

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 6B, page "SUPPLEMENT 1".

| | | | | | |
|-----------------------|--|--|------------------------------|---|---|
| H | $\sigma_t(14.1 \text{ Mev})$ 0.689 | H. L. Poss et al., Phys. Rev. 85, 703A(1952). | ${}^6\text{C}_6^{12}$ | Resonances E_0 Γ E_γ 0.162 4.45, 11.6 0.67 0.31 4.44, 12.0, 16.4 1.37 1.15 4.45, 12.7, 16.9 scin | B(p, γ) T. Huus, R. B. Day, Phys. Rev. 85, 761A(1952). |
| ${}^3\text{Li}_4^7$ | $\text{Li}^6(\text{d}, \text{p}\gamma)\text{Li}^7$ $\text{p}\gamma(\theta) = \text{constant}$ $E_d = 0.5$ | W. H. Burke, J. R. Risser, Phys. Rev. 85, 741A(1952). | | Level 4.20 $\text{C}^{12}(\text{p}, \text{p})$ a | N. P. Heydenburg et al., Phys. Rev. 85, 742A(1952). |
| | $\text{Li}^6(\text{d}, \text{p}\gamma)\text{Li}^7$ $\text{p}\gamma(\theta) = \text{constant}$ $E_d = 1.0$ | G. C. Phillips et al., Phys. Rev. 85, 742A(1952). | | | |
| ${}^4\text{Be}_3^7$ | No $\gamma\gamma$ scin | F. R. Metzger, Phys. Rev. 85, 727A(1952). | ${}^6\text{C}_7^{13}$ | σ_s coh 4.5 (+) σ_s bound 5.5 | W. C. Koehler, E. O. Wollan, Phys. Rev. 85, 491(1952). |
| | Level 0.432 $\text{B}^{10}(\text{p}, \alpha\gamma)$ scin No other γ with $E_\gamma < 1.0$ | R. B. Day, T. Huus, Phys. Rev. 85, 761A(1952). | ${}^7\text{N}_7^{14}$ | Levels 2.35, 3.95 $\text{N}(\text{p}, \text{p})$ a | N. P. Heydenburg et al., Phys. Rev. 85, 742A(1952). |
| ${}^4\text{Be}_5^9$ | Level 2.57 $\text{Be}^9(\text{p}, \text{p})$ a | N. P. Heydenburg et al., Phys. Rev. 85, 742A(1952). | ${}^8\text{O}_7^{15}$ | Capture γ 's $\text{N}(\text{p}, \gamma)$ 0.75, 1.38, 2.38, 5.3, 6.4, 7.0 scin | C. H. Johnson et al., Phys. Rev. 85, 727A(1952). |
| ${}^6\text{B}_5^{10}$ | Level 0.718 $\text{B}(\text{p}, \text{p}\gamma)$ scin | R. B. Day, T. Huus, Phys. Rev. 85, 761A(1952). | ${}^8\text{O}_9^{17}$ | $\text{O}^{16}(\text{d}, \text{p}\gamma)\text{O}^{17}$ $\text{p}\gamma(\theta) = \text{constant}$ $E_d = 1.7, 2.0$ | G. C. Phillips et al., Phys. Rev. 85, 742A(1952). |
| | Level 2.34 $\text{B}^{10}(\text{p}, \text{p})$ a | N. P. Heydenburg et al., Phys. Rev. 85, 742A(1952). | ${}^9\text{F}_{10}^{19}$ | Levels 1.53, 3.83 $\text{F}(\text{p}, \text{p})$ a | N. P. Heydenburg et al., Phys. Rev. 85, 742A(1952). |
| ${}^5\text{B}_6^{11}$ | Level 2.06 $\text{B}^{11}(\text{p}, \text{p})$ a | N. P. Heydenburg et al., Phys. Rev. 85, 742A(1952). | Ne | Levels 1.44, 4.36 $\text{Ne}(\text{p}, \text{p})$ a | N. P. Heydenburg et al., Phys. Rev. 85, 742A(1952). |
| | $\text{B}^{10}(\text{d}, \text{p}\gamma)\text{B}^{11}$ $\text{p}\gamma(\theta) = \text{constant}$ $E_d = 1.8$ | G. C. Phillips et al., Phys. Rev. 85, 742A(1952). | ${}^{10}\text{Ne}_{10}^{20}$ | No n thresholds for $E_d = 0.5 - 2$ $\text{F}^{19}(\text{d}, \text{n})$ | J. W. Butler, Phys. Rev. 85, 743A(1952). |
| C | $\sigma_t(14.1 \text{ Mev})$ 1.279 | H. L. Poss et al., Phys. Rev. 85, 703A(1952). | ${}^{11}\text{Na}_{12}^{23}$ | Level 3.67 $\text{Na}(\text{d}, \text{p})$ a | N. P. Heydenburg et al., Phys. Rev. 85, 742A(1952). |
| ${}^6\text{C}_6^{11}$ | Resonance $\text{B}^{10}(\text{p}, \alpha\gamma)$ 1.52 | R. B. Day, T. Huus, Phys. Rev. 85, 761A(1952). | ${}^{12}\text{Mg}_{12}^{24}$ | $(1.4\gamma)\text{p}(\theta)$ $\text{Mg}^{24}(\text{p}, \text{p}\gamma)$ | H. E. Gove, A. Hedgran, Phys. Rev. 85, 727A(1952). |

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| $^{13}\text{Al}_{11}^{24}$ | τ 2.3 ^s Delayed α emitter $E_p = 15.4$ | Mg(p,n) A. C. Birge, Phys. Rev. 85, 753A(1952). | $^{38}\text{Sr}_{47}^{85}$ 65 ^d | K γ 100% 0.513 scin $\alpha = 0.008$ M2 $\tau = 0.9^{\mu\text{s}}$ | A. W. Sunyar et al., Phys. Rev. 85, 734A(1952); priv. comm. Rb(d); chem. |
| $^{13}\text{Al}_{14}^{27}$ | Levels 1.02, 2.30, 2.89, a 3.32, 4.48 | Al(p,p) N. P. Heydenburg et al., Phys. Rev. 85, 742A (1952). | $^{43}\text{Tc}_{51}^{94}$ | 51.5 ^m activity now assigned to Tc^{96} , q.v. | H. A. Medicus, H. T. Easterday, Phys. Rev. 85, 735A(1952). |
| $^{14}\text{Si}_{17}^{31}$ | τ 2.65 \pm 0.01 ^h β^- 1.471 sl | Levels Al(p,p) 22 tentative values E. M. Reilley et al., Phys. Rev. 85, 704A(1952). H. T. Motz, Phys. Rev. 85, 501(1952). P^{31} (pile n,p); chem. | $^{43}\text{Tc}_{53}^{96}$ | τ_1 51.5 ^m Mo ⁹⁶ (p,n) Formerly assigned $E_p = 4$ to Tc^{94} | H. A. Medicus, H. T. Easterday, Phys. Rev. 85, 735A(1952). |
| $^{15}\text{P}_{17}^{32}$ | β^- 1.697 sl | H. T. Motz, Phys. Rev. 85, 501(1952). | $^{43}\text{Tc}_{56}^{99}$ | μ +5.6586 I [Based on $\mu(\text{H}^1) = 2.7934$; $\nu(\text{D})/\nu(\text{H}^1) = 0.153506$] | H. Walchli et al., Phys. Rev. 85, 479(1952). |
| $^{17}\text{Cl}_{19}^{36}$ | I 2 Mic q -0.0164 Mic | D. A. Gilbert, Phys. Rev. 85, 716A(1952). | $^{45}\text{Rh}_{61}^{106}$ | β^- 3% 2.0 sl 12% 2.44 11% 3.1 68% 3.53 | D. E. Alburger, Phys. Rev. 85, 734A(1952). *Relative intensities from pe ⁻ . **priv. comm. |
| $^{19}\text{K}_{21}^{40}$ | $g_1(\text{K}^{40})/g_1(\text{K}^{39})$ -1.2434 \pm 0.0003 M | J. T. Eisinger, B. Bederson, Phys. Rev. 85, 716A(1952). | | γ 1* 0.513 sl;pe ⁻ $\alpha_k = 3.5 \times 10^{-3}$, K/L = 8 0.53* 0.624 $\alpha_k = 2.1 \times 10^{-3}$ 0.03* 0.87 0.08* 1.045 0.025* 1.55 0.01** 2.41** | |
| $^{22}\text{Ti}_{27}^{49?}$ | I $\frac{1}{2}$? I μ -1.1024 I [Based on $\mu(\text{H}^1) = 2.7934$] | C. D. Jeffries et al., Phys. Rev. 85, 478 (1952). | $^{47}\text{Ag}_{58}^{105}$ | γ' s sl;ce ⁻ γ_1 0.0625 K/L > 5 γ_2 0.280 K/L = 8 γ_3 0.343 K/L = 5.8 γ_4 0.440 K/L = 7 Weak: 0.154, 0.181, 0.391 $\gamma_{172}, \gamma\gamma$ | R. W. Hayward, Phys. Rev. 85, 760A(1952); priv. comm. Rh($\alpha, 2n$); Pd(d). |
| $^{26}\text{Fe}_{33}^{58}$ | γ 2.5% 0.195 scin (0.195 γ)(1.0 γ) coin | F. R. Metzger, Phys. Rev. 85, 727A(1952). | $^{47}\text{Ag}_{59}^{106}$ | γ' s sl,ce ⁻ 0.220 0.717 0.409 0.815 0.511 1.04 K/L = 8 1.235 0.620 1.55 | R. W. Hayward, Phys. Rev. 85, 760A(1952); priv. comm. Rh(α, n); Pd(d). |
| Ni | 13 levels Ni(p,p) unassigned to isotope | R. Ely, Jr., et al., Phys. Rev. 85, 704A(1952). | $^{52}\text{Te}_{73}^{125}$ 58 ^d | γ 0.110 $\alpha_k = 160$ } sl; (0.035) } ce ⁻ , $\alpha_k = 11.4$ Ml } scin, K/L = 7.1, } pc L/M = 5.3 | P. Axel, J. C. Bowe, Phys. Rev. 85, 734A (1952). |
| $^{28}\text{Ni}_{32}^{60}$ | Levels Ni(p,p) 1.338, 1.475, 2.497 | N. P. Heydenburg et al., Phys. Rev. 85, 742A (1952). R. Ely, Jr., et al., Phys. Rev. 85, 704A(1952). | $^{53}\text{I}_{78}^{131}$ | (0.080 γ)(0.284 γ)(θ) constant | D. Schiff, Phys. Rev. 85, 727A (1952). |
| $^{33}\text{As}_{42}^{75}$ | I $\frac{3}{2}$ I μ +1.4354 I [Based on $\mu(\text{H}^1) = 2.7934$] | C. D. Jeffries et al., Phys. Rev. 85, 478(1952). | $^{58}\text{Ce}_{86}^{144}$ | β^- 97% 0.307 s 3% 0.446 γ 0.0547 0.0794 K/L = 6.3 0.134 K/L = 8.3 0.231 K/L = 1.7 | L. S. Cheng et al., Phys. Rev. 85, 487(1952). Fission; chem. |
| $^{34}\text{Se}_{45}^{79}$ 6.5 $\times 10^{4y}$ | I $\frac{1}{2}$ Mic q 1.2 | W. A. Hardy et al., Phys. Rev. 85, 494(1952). Fission: chem. | | | |
| $^{38}\text{Sr}_{47}^{85}$ 70 ^m | K 14% γ 84.7% 0.0075 α = large E3 0.150 84.7% 0.225 M1 $\alpha \sim 0.026$, K/L ~ 5 1.3% 0.233 M4 (0.150 γ)X No (0.233 γ)X | A. W. Sunyar et al., Phys. Rev. 85, 734A(1952); priv. comm. Sr ⁸⁴ (pile n). (Rb) | | | |

| | | | | | | | | | | | |
|---|--|----------------|-------|---------|--|---------------------------------|-------------------------|---|------------------|--|--|
| $^{144}_{85}\text{Pr}$ | β^- | 3% | 0.605 | s | L. S. Cheng et al., Phys. Rev. <u>85</u> , 487(1952). | $^{210}_{127}\text{Bi}$ long | α | 4.93 | Bi(n, γ) | H. B. Levy, I. Perlman, Phys. Rev. <u>85</u> , 758A(1952). | |
| | | 12% | 1.30 | | | | | | ms | | |
| | | 85% | 3.00 | | | | | | | | |
| $^{150}_{88}\text{Gd}$ | β^- | | 2.97 | s π | F. T. Porter, C. S. Cook, Phys. Rev. <u>85</u> , 733A(1952). | $^{210}_{126}\text{Po}$ | $\alpha\gamma$ | delay $<10^{-9}\text{s}$ | scin | S. DeBenedetti, G. H. Minton, Phys. Rev. <u>85</u> , 726A(1952). | |
| | τ | long | | | S. G. Thompson et al., Phys. Rev. <u>85</u> , 758A(1952). | | $^{228}_{140}\text{Ra}$ | $\sigma(\text{th } n, \gamma\beta) 66^m\text{Ac} \sim 36$ | | | F. Depocas, B. Harvey, Phys. Rev. <u>85</u> , 499(1952). |
| | α | 2.7 | | | | | | | | | |
| Dy | 7 ^m α activity formerly Tb or Gd now assigned to Dy. $E_d = 4.2$. | | | | S. G. Thompson et al., Phys. Rev. <u>85</u> , 758A(1952). | $^{230}_{142}\text{Ra}$ | | τ | 1 ^h | s π | W. A. Jenkins, G. T. Seaborg, Phys. Rev. <u>85</u> , 758A(1952). |
| $^{176}_{71}\text{Lu}$ 3.75 ^h | β^- | 1.1 | | | G. Scharff-Goldhaber, et al., Phys. Rev. <u>85</u> , 734A(1952). | | $^{229}_{140}\text{Ac}$ | β^- | 1.2 | | Th(180 Mev d) chem. |
| | | 1.2 | | | | | | | | | |
| | γ | 0.089 | scin | | $\alpha = \text{large}$ K/L ~ 0.1 No γ with $0.6 < E_\gamma < 1$ (1.1 β)(0.089 γ) delay $< 1^{\mu\text{s}}$ | E2 | | | τ | 66 ± 5^m | F. Depocas, B. Harvey, Phys. Rev. <u>85</u> , 499(1952). |
| Pb | $\sigma_a(\text{th } n)$ | | 0.162 | osc | D. J. Littler, E. E. Lockett, priv. comm. (1952). | $^{228}_{140}\text{Ra}$ | τ | 67 ^m | | Ra ²²⁸ (n, $\gamma\beta$); chem. | |
| $^{206}_{82}\text{Pb}$ | $\sigma_a(\text{th } n)$ | | 0.026 | osc | D. J. Littler, E. E. Lockett, priv. comm. (1952). | | $^{230}_{141}\text{Ac}$ | τ | $< 1^m$ | | W. A. Jenkins, T. Seaborg, Phys. Rev. <u>85</u> , 758A(1952). |
| | | | | | | | | | | | |
| | $\sigma_a(\text{th } n)$ | | 0.69 | osc | D. J. Littler, E. E. Lockett, priv. comm. (1952). | $^{241}_{146}\text{Am}$ | | β^- | 2.2 | s π | W. A. Jenkins, T. Seaborg, Phys. Rev. <u>85</u> , 758A(1952). |
| $^{207}_{82}\text{Pb}$ | α | ~ 4.85 | | pc | D. C. Dunlavey, T. T. Seaborg, Phys. Rev. <u>85</u> , 757A(1952). | | | τ | 470 ^y | | B. G. Harvey, Phys. Rev. <u>85</u> , 482(1952). |
| | α/K | $\sim 10^{-7}$ | | | Pb(60 Mev p); chem. | | | | | | |

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